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THE

BOTANICAL GAZETTE

EDITORS:

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VOLUME XVI

1891
CRAWFORDSVILLE, INDIANA
PUBLISHED BY THE EDITORS

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IT

PRESS OF
TRACY, GIBBS & COMPANY,
MADISON, WIS.

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[ISSUED JANUARY 15.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

THE BOTANICAL GAZETTE.

A Monthly Journal Embracing all Departments of Botanical Science.

ANNUAL SUBSCRIPTION, $2.50.

SINGLE NUMBERS, 25 CENTS.

The subscription price is an invariable one, no concession being made to dealers or agents.

In Great Britain, 11 shillings.
Agent, W. P. COLLINS,
157 Great Portland St., London, W.

In Germany, 11 marks.
Agent, R. FRIEDLÄNDER & SOHN,
11 Carlstrasse, Berlin, N. W.

Subscriptions and correspondence should be addressed to ***Charles R. Barnes, 712 Langdon St., Madison, Wisconsin;*** money orders and drafts should be made payable to the BOTANICAL GAZETTE.

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BOTANICAL GAZETTE

VOL. XVI.— CRAWFORDSVILLE, IND., JANUARY, 1891. —NO. 1.

Undescribed plants from Guatemala. VIII.

JOHN DONNELL SMITH.

(WITH PLATES I AND II.)

Prof. Alfred Cogniaux, Dr. M. T. Masters and Dr. W. O. Focke, distinguished monographers of orders, have contributed to this paper descriptions of new species detected by them among the plants submitted to them respectively for determination.

Bocconia vulcanica.— Branchlets, foliage and panicle smooth and shining; leaves glaucous beneath, obovate-elliptical (5–6 × 2½ in.), acute apex long-mucronate, tapering below to broadly sessile base, margin evenly glandulo-mucronate with rounded indentations: bracts foliaceous, bractlets scarious: sepals oval (6 × 3½ lines), exceeding pedicels, recurved-cuspidate: 10–15 stamens a third shorter, filaments half as long as linear anthers: stout style prolonged from ovary, a half shorter than stigmas: capsule (immature) elliptic-oblong, twice exceeding stipe. — *B. integrifolia* Humb. et Bonpl., likewise arborescent and with lobeless leaves crowded about base of large drooping panicle, is distinct by indument, long-petiolate leaves entire or nearly so, stamens equaling calyx, subsessile anthers.— Slopes of Volcan de Agua, Dept. Zacatepequez, alt. 10,000 feet, April, 1890, J. D. S. (Ex Pl. Guat. qu. edid. J. D. S. 2172.)

Chorisia soluta.— Calyx shortly pedunculate, 3-bracteolate, ligneous, cupulate-campanulate (20 lines long), aureolanate within, irregularly 5-lobed: petals distinct, linear-spatulate (5–6 in. × 10 lines), apex emarginate, sericeo-tomentose and fuscous without, glabrate and red within: stamens three-fourths as long; column short (10 lines), annulate at apex;

exterior lobes one-fifth as long, ovate, entire, hirsute; interior branches 10–12, filiform, 2-antheriferous, anthers long and anfractuose: ovary free, imperfectly 5-celled, ovules pyriform.—A tree with the gigantic trunk and flat widespreading head of *Bombax Ceiba* L., and with digitate leaves. The incomplete character is drawn from the only parts within reach of the collector—freshly fallen flowers. The staminal column partite to annulus into doubled number of branches is exceptional for the genus.—Shores of Lake Amatitlan, Dept. Amatitlan, alt. 3,900 feet, Feb., 1890, J. D. S. (Ex Pl. cit. 1924.)

Myrodia Guatemalteca.—Leaves elliptical or obovate-elliptical (8–10 × 3–4 in.), abruptly acuminate, obtuse base 3-nerved, veins pubescent, axils barbate: flowers solitary or geminate, axillary and extra-axillary, approximated: calyx twice longer than deflexed minutely 3-bracteolate pedicel, sericeous within, 5–6 unequal lobes ovate (2–3 lines): petals tomentulose, elliptic-oblong (1 in.), shortly unguiculate, half-exsert: staminal column shorter, its 5 lobes regularly 4-antheriferous: cells of ovary 2, 2-ovulate, style pentagonal, stigma bilobed: immature fruit ovoid (5 lines).—*M. funebris* Benth., *ex descr.* nearly related, differs by lanceolate leaves, subsessile solitary flowers, erose calyx equalling claws of petals and twice exceeded by 25–30-antheriferous staminal column.—Pansamalá forest, Dept. Alta Verapaz, alt. 4,000 feet, Jan., 1889, v. Türckheim (Ex Pl. cit. 1410): April, 1889, J. D. S. (Ex Pl. cit. 1634.)

Heteropteris retusa.—Leaves short-obovate (20–24 × 15–18 lines), each end obtuse, apex retuse and cuspidate, sparsely pilose, veins rufo-pubescent and uni-glandular above base of lowest pair; petiole terete, bi-glandular at or below apex: panicles rufo-tomentulose, 2–3-fasciculate from axils of reduced upper leaves and terminal, umbellately compound, sub-equalling leaves; pedicels 3–5, bracteolate in middle, exceeding flowers: sepals minute: petals twice longer (2 lines), oblong, base rounded, carinate, shortly unguiculate, crimson; the interior broader with stout claw and denticulate: filaments exceeding calyx, anthers oblong, connective incrassate: styles a little shorter.—Near *H. cotinifolia* Ad. Juss., but with different leaves and glands, solitary panicles, smaller flowers, etc.—Erect shrub 8–12 feet high with brachiate lenticellate branches, along streams near Escuintla, Dept. Escuintla, alt. 1,100 feet, March, 1890, J. D. S. (Ex Pl. cit. 2068.)

RUBUS OCCIDENTALIS L., var. **grandiflora** Focke.—Differt a planta typica floribus fere duplo majoribus post anthesin nutantibus.—Slopes of Volcan de Aqua, alt. 8,500 feet, April, 1890, J. D. S. (Ex Pl. cit. 2168.)

Potentilla Donnell-Smithii Focke.—Caudiculi e radice multicipite breves lignosi stipulis annorum præcedentium scariosis vestiti. Caules prostrati digitales pubescentes, apice ascendentes ramosi pauciflori. Folia inferiora petiolata imparipinnata trijuga vel bijuga, foliolis approximatis, *infimis majoribus manifeste petiolulatis,* aliis lateralibus subsessilibus. Foliola inæquilatera sub-ovata inciso-serrata, serraturis confertis obtusis, utrinque appresse pilosa. Folia superiora ternata breviter petiolata, foliolis illis foliorum inferiorum similibus. Stipulæ vaginantes petiolo adnatæ, inferiores scariosæ, supremæ magna ex parte liberæ ovatæ dente uno alterove præditæ. *Flores breviter pedunculati,* pedunculo diametrum floris fere æquante, folia vix superante. *Bracteolæ calycinæ* sepalis fere æquilongæ *trilobæ* (vel inciso-tridentatæ) ; sepala late ovata, interdum dente uno alterove prædita. Petala obovata sepalis longiora lutea. Styli subterminales basi incrassati. Torus hirsutus.—Planta alpina humilis. Habitu ad *P. dissectam* Pursh, *P. Richardii* Lehm. et *P. Ehrenbergianam* Schldl. accedit, sed et ab his et ab omnibus aliis speciebus Americanis distinguitur bracteolis calycinis trilobis.—Bottom of crater of extinct Volcan de Agua, alt. 12,000 feet, April, 1890, J. D. S. (Ex Pl. cit. 2144.)

AGRIMONIA PARVIFLORA Ait.? var. **macrocarpa** Focke.—Differt a planta typica fructibus majoribus, foliolis paucioribus et brevioribus.—The determination is provisional. In many cases it is very difficult to trace the limits between the closely allied species of *Agrimonia.* The Guatemala specimen agrees in essential points with the *A. parviflora* of the United States. Its fruits are much larger, but show the same shape and the same direction of spines. The leaflets are less numerous and nearly as narrow, but shorter. These differences are not very important, and therefore I prefer at present to consider the plant as a variety. A more complete acquaintance, however, will perhaps disclose distinctive marks of greater importance. (Focke).—Coban, Dept. Alta Verapaz, alt. 4,300 feet, Feb., 1889, v. Türckheim. (Ex Pl. cit. 1409.)

Tibouchina Bourgaeana Cogn. (§ DISTANTHERA); ramis setis arcte adpressis basi tuberculatis subsparse armatis; foliis mollibus, anguste lanceolatis, longiuscule acuminatis, basi satis attenuatis, subtiliter serrulatis, utrinque adpresse pilosis, 5-nerviis, nervis lateralibus basi longiuscule coalitis; cymis plurifloris; calycis tubo ovoideo, lobis subulatis, tubo brevioribus; staminibus omnine glabris, subaequalibus; antheris brevibus, oblongis, apice obtusis, connectivo basi brevissime producto. Rami graciles, erecti. Petiolus 0.5–1.5cm. longus. Folia 4–8cm. longa, 8–17mm. lata. Calycis tubus 2.5mm. longus; lobi 1.5–2mm. longi. Petala lilacina, ciliata, apice setoso-apiculata, 4–5mm. longa. Antherae 1.5mm. longae. Stylus 4mm. longus.—Yzabal, Dept. Yzabal, alt. 100 feet, April, 1889, J. D. S. (Ex Pl. cit. 1514).

Monochaetum diffusum Cogn. (§ EUMONOCHAETUM); ramis junioribus pilis patulis simplicibus eglandulosis densiuscule longeque hirtellis; foliis longiuscule petiolatis, membranaceis, oblongo-lanceolatis, acutiusculis, triplinerviis, subadpresse sparseque setulosis praecipue subtus ad nervos; cymis diffusis, plurifloris; calyce pilis patulis glandulosis sparse hirtello, lobis tubum aequantibus.—Rami graciles, obscure tetragoni, fuscescentes, satis ramulosi, diffusi. Petiolus filiformis, 4–8mm. longus. Folia supra laete viridia, subtus pallida, 3–5cm. longa, 1–1.5cm. lata. Flores rosei, longe graciliterque pedicellati. Calycis tubus cinereus, campanulatus, 4–5mm. longus; lobi patuli, triangulari-lineares, 4–5mm. longi. Petala obovata, apiculata, 6–7mm. longa. Antherae majores arcuatae, 4mm. longae, cauda paulo incrassata elongata sursum revoluta; minores subrectae, 3mm. longae, cauda subfiliformi adscendente.—Pinula, Dept. Guatemala, alt. 4400 feet, Feb., 1890, J. D. S. (Ex Pl. cit. 2217).

Conostegia hirtella Cogn.; ramis junioribus petiolisque setulosis; foliis oblongo-lanceolatis, basi acutis vel acutiusculis, apice longiuscule acuminatis, integerrimis vel vix undulato-denticulatis, 5-plinerviis, supra sparsissime setulosis, subtus ad nervos leviter hirtellis et vix furfuraceis caeteris glabratis; alabastris anguste obovoideis, acutiusculis, vix furfuraceis.—Rami satis graciles, obscure tetragoni, juniores densiuscule et breviuscule hirtelli. Petiolus supra densiuscule breviterque hirtellus caeteris breviter furfuraceus, 1–2.5 cm. longus. Folia membranacea, paulo disparia, 13–19 cm. longa, 4–5.5 cm. lata. Paniculae furfuraceo-hirtellae, submultiflorae, fere 1 dm. longae; flores 5-meri, distincte pedicellati. Alabastra 6 mm. longa, 3.5 mm. crassa. Petala late obovata, profunde emarginate, 5–6 mm. longa. Antherae oblongo-lineares, 2.5 mm. longae. Stylus crassiusculus, 3 mm. longus, stigmate obtuso.—Pansamalá forest, alt. 3,800 feet, May 1887, v. Türckheim. (Ex Pl. cit. 1233.) Distributed as *C. lasiopoda* Benth.?

Miconia Guatemalensis Cogn. (§ OCTOMERIS); foliis breviuscule petiolatis, membranaceis, ovatis, breviter acuminatis, basi rotundatis vel vix emarginatis, integerrimis vel minutissime denticulatis et setulis brevissimis patulis densiuscule ciliatis, 5-nerviis, supra sparse setulosis, subtus ad nervos leviter furfuraceis caeteris brevissime subsparseque stellato-puberulis; paniculis laxiusculis, submultifloris; floribus 5-meris; calyce leviter furfuraceo, lobis brevissimis, late rotundatis.—Frutex ramis robustiusculis junioribus petiolis paniculisque brevissime et densiuscule stellato-pub erulis. Petiolus 1–4 cm. longus. Folia 6–9 cm. longa, 3. 5–5 cm. lata. Paniculae 4–8 cm. longae; pedicelli saepius vix 1 mm. longi. Calycis tubus suburceolatus, 2 mm. longus; lobi vix 1 mm. longi. Petala ut videtur rubra, 3 mm. longa. Stylus 4 mm. longus.—Tamahu, Dept. Alta Verapaz, alt. 5,000 feet, July 1887, v. Türckheim. (Ex Pl. cit. 924, 1317.)

Miconia Tuerckheimii Cogn. (§ OCTOMERIS); ramis junioribus petolis paniculis foliisque subtus brevissime denseque stellato-tomentosis; foliis anguste ovatis, breviter acuminatis, minute denticulatis, 7-nerviis, supra brevissime denseque villoso-hirtellis; floribus 4-meris, pedicellatis; calyce stellato-tomentoso et sparse glanduloso-piloso.— Petiolus 3–8cm. longus. Folia submembranacea, basi rotundata, 2–2.5dm. longa, 12–14 cm. lata. Paniculae 2.5 dm. longae; pedicelli glandulosi, 1–3 mm. longi. Calyx 3 mm. longus, breviter lobatus. Petala 3 mm. longa.—Coban, alt. 4,800 feet., Mch. 1881, v. Türckheim (Ex Pl. cit. 581).

Clidema laxiflora Walp., var. *β*. **longipetiolata** Cogn.—Rami petioli pedunculique longiore pilosi. Petiolus 5–7 cm. longus. Folia profundiore inaequaliter serrulata. Calyx longe denseque hirsutus.—Pansamalá, alt. 3,800 feet, June 1885, v. Türckheim (Ex Pl. cit. 707). Distributed as typical.

Clidemia Donnell-Smithii Cogn. (§ SAGRAEA); ramis junioribus petiolisque pilis patulis elongatis pallide fulvis dense vestitis; foliis submembranaceis, longiuscule petiolatis, oblongis vel ovato-oblongis, subintegerrimis, longiuscule acuminatis, basi rotundatis, 7-nerviis, supra breviter sparseque setulosis, subtus densiuscule longeque pilosis; cymis parvis, paucifloris; pedicellis longiusculis, minute bibracteolatis; calyce densiuscule longeque hirtello, dentibus exterioribus subulatis, tubum aequantibus.—Rami robustiusculi, teretes, simplices. Petiolus robustiusculus, 2–6 cm. longus. Folia saepius satis disparia, supra intense viridia, subtus viridi-cinerea, 10–18 cm. longa, 4.5–7.5 cm. lata. Cymae patulae, 2–3 cm. longae; pedicelli filiformes, 6–8 mm. longi; bracteolae subulatae, 1 mm. longae. Calycis tubus campanulatus, 3 mm. longus; dentes exteriores erecto-patuli, flexuosi, 2.5–3 mm. longi. Petala rubra, obovata, apice rotundata, 4–5 mm. longa. Antherae oblongo-lineares, 1.5 mm. longae. Stylus capillaris, 5–7 mm. longus, stigmate punctiformi.—Pansamalá, alt. 3,800 feet, July, 1888, v. Türckheim. (Ex Pl. cit. 1433.)

JUSSIÆA PERUVIANA L., var. **glaberrima**.—Absolutely smooth throughout: peduncle and calyx nitidous: sepals mucronate and denticulate: flowers 2 in. in diameter: stamens 8, oblong anthers equalling filaments: capsule elongated.—Shrub 12 ft. high, swamp near Dueñas, Dept. Zacatepequez, alt. 5,000 ft., Apr. 1890, J. D. S. (Ex Pl. cit. 2130.)

JUSSIÆA PILOSA H. B. K., var. **robustior**.—Densely branched shrub, 6–8 ft. high, angulate with decurrent petioles and branches: leaves crowded, small, fleshy, scabrid, sprinkled with red glands, margin rubescent: bracts minute, subulate, gland-stipellate: flowers 6-merous, sepals splitting in fruit to 7–9: seeds of one of the cells often biseriate.—Swamp on Lake Antonio near Dueñas, alt. 5,000 ft., Apr. 1890, J. D. S. (Ex Pl. cit. 2123.)

Passiflora (§ CIEGA) **clypeophylla** Mast.—Glabra, ramis complanatis sulcato-striatis; petiolis 20–30 mm. longis medio glandulis duabus majusculis sessilibus munitis; stipulis herbaceis lineari-subfalcatis acutis; laminis circa 6 cm. long. 10 cm. lat. glabris submembranaceis peltatis 5-nerviis subrotundis vel obscure trilobis margine incrassato albido angusto circumdato; pedunculis petiolos subaequantibus simplicibus supra medium articulatis; bracteis caducis minutis; floribus diametro 10–12 mm. tubo brevi campanulato intus plicato; sepalis oblongis glabris; corona fauciali biseriata filamentosa, filis externis sepala subaequantibus basi purpureis apicem versus luteis, filis intimis lineari-clavatis truncatis procedentibus tertia parte brevioribus; corona media membrancea longitudinaliter plicata purpurea margine in dentes acutos inflexos margine eversos divisa, corona infra mediana annulari; gynophoro glabro; ovario globoso glabro. —Barranca del Rubelcruz, Dept. Alta Verapaz, alt. 2,500 ft., April, 1889, J. D. S. (Ex Pl. cit. 1625.)

Passiflora (§ DECALOBA) **allantophylla** Mast.—Setulosa, ramis herbaceis compressis sulcato-striatis; petiolis 15 mm. eglandulosis; stipulis lineari–subulatis; laminis circa 20 mm. long. 40–50 mm. lat. membranaceis glabris subtus sparse ocellatis palmatim 3-nerviis basi late cordatis vel subrotundatis, ad medium bilobatis, lobis divergentibus rotundatis nervo excurrente mucronulatis; lobulo intermedio subobsolete truncato sinu latissimo; pedunculis geminis petiolos aequantibus vel superantibus simplicibus vel superne cymoso-tribrachiatis; bracteis setaceis caducis; floribus 10–12 mm. diam., tubo brevi patelliformi basi intruso extus intusque glabro; sepalis herbaceis oblongis obtusis; petalis hyalinis albidis sepalis parum brevioribus; corona fauciali 1-seriata filamentosa, filis ligulatis flavidis basi purpurascentibus quam petala parum brevioribus; corona mediana membranacea tubulata apice in lobos acutos inflexos fimbriatulos ad margines eversos divisa; coronâ infra mediana carnosula anguste annulari; corona basilari praecedenti conformi; gynophoro glabro; ovario subgloboso glabro.—Santa Rosa, alt. 5,000 feet, Sept. 1888, v. Türckheim (Ex Pl. cit. 1425.)

Passiflora (§ DECALOBA) **transversa** Mast.—Glabrescens vel subhirtella; ramis complanatis sulcato-striatis; petiolis 2 cm. long. eglandulosis; stipulis subulatis herbaceis; laminis 4 cm. long. 12–13 cm. lat. subcoriaceis glabris transversim ellipticis, 3-nerviis, basi ocellatis, apice mucronulatis nonnunquam excisis; pedunculis petiolis dimidio brevioribus puberulis bracteis setaceis munitis. Floribus diametro 35 mm. tubo patulo brevi extus puberulo intus glabro; sepalis herbaceis oblongo-obtusis; petalis sepalis parum brevioribus albidis; corona fauciali filamentosa biseriali, filis extimis liguliformibus flavis petalis paulo brevioribus, filis intimis fere dimidio brevioribus; corona media membranacea tubulata superne in dentibus puberulis inflexis divisa; corona basilari carnosula annulari; gynophoro glabro pentago; filamentis gracilibus; ovario oblongo glabro.—Masaqua, Dept. Escuintla, alt. 400 feet, April, 1890, J. D. S. (Ex Pl. cit. 2099.)

Passiflora (§ DECALOBA) **ornithoura** Mast.—Glabra; ramis compressis sulcato-striatis; stipulis lineari-subulatis caducis; petiolis circa 25mm. long. eglandulosis; laminis 10cm. long. 5 cm. lat. membranaceis subtus sparse ocellatis basi cuneatis vel subrotundatis, palmatim 3-nerviis infra medium bilobatis, lobis late divergentibus lanceolatis, secus nervum medianum fascia albida angusta notatis, lobo intermedio deltoideo subobsoleto; pedunculis geminis simplicibus petiolos aequantibus; bracteis minimis filiformibus acutis; floribus diametri 2cm.; tubo brevi patelliformi extus puberulo intus nitido; sepalis herbaceis oblongo-obtusis; petalis hyalinis albidis sepalis tertia parte brevioribus; corona fauciali 1-seriata e filis crassis clavatis petalis dimidio brevioribus constante; corona mediana membranacea tubulata longitudinaliter plicata margine lobata lobis lanceolatis inflexis marginibus eversis fimbriatulis; corona basilari annulari carnosula; gynophoro tereti glabro; ovario globoso glabro; fructu globoso magnitudine cerasi parvi purpureo; seminibus albidis transverse sulcatis, striisque longitudinalibus notatis.—Dueñas, alt. 5,000 feet, April, 1890, J. D. S. (Ex Pl. cit. 2136.)

Passiflora (§ DECALOBA) **dicthophylla** Mast.—Glabra, ramis compressis striatis; petiolis circa 25 mm. eglandulosis; stipulis lineari-subulatis; laminis 5–6 cm. long. 4–5 cm. lat. membranaceis sparse ocellatis vel eglandulosis basi subcuneatis vel subrotundatis palmatim 3-nerviis, infra medium 2-lobatis, lobis divergentibus oblongis obtusiusculis, mucronulatis, sinu lunatim exciso lobulo intermedio obsoleto; pedunculis geminis petiolos aequantibus vel superantibus simplicibus; bracteis setaceis minutis munitis; floribus diametro 15 mm., tubo brevi late campanulato; sepalis herbaceis oblongis obtusis; petalis albidis sepalis dimidio brevioribus; corona fauciali filamentosa, filis uniseriatis lineari-clavatis petalis fere dimidio-breviorbus; corona media membranacea late tubulata plicata margine profunde dentata, dentibus fimbriatulis; corona infra mediana annulari crassa; gynophoro glabro; ovario globoso nitido; fructu magnitudine cerasi globoso glabro purpureo; seminibus compressis apice productis tranversim annulato striisque verticalibus notatis.—Dueñas, alt. 5,000 feet, April 1890, J. D. S. (Ex Pl. cit. 2143).

Melothria Donnell-Smithii Cogn. (§ EUMELOTHRIA); monoica; foliis membranaceis, ovatis vel ambitu suborbicularibus, utrinque punctato-scabris, integris vel usque ad medium 3–5-lobatis, lobis apice saepius rotundatis terminali interdum acuto; cirrhis simplicibus; racemis masculis saepius 3–5-floris, petiolo brevioribus; petalis leviter emarginatis; antheris subquadratis, loculis paulo arcuatis, connectivo lato; floribus femineis longe pedunculatis, fructu majusculo, triloculari, concolore; seminibus immarginatis.—Rami graciles, elongati, glabri vel vix pilosuli, laeves, alternatim albo et viridi longitudinaliter striati. Petiolus satis gracilis, brevissime subsparseque hirtellus vel glabratus, 2–5 cm. longus. Folia ovata, integra vel saepius paulo lobata, apice acuta, 6–8 cm. longa, 5–7 cm. lata, supra intense viridia, subtus paulo pallidiora et ad nervos interdum brevissime hirtella, margine minute remoteque denticulata; sinus basilaris saepius angustus, 1–1.5 cm. profundus. Cirrhi graciles, sulcati, glabri. Pedunculus communis masculus gracilis, puberulus, 1.5–3 cm. longus, apice 2–15-florus; pedicelli 3–10 mm. longi. Calyx campanulatus, basi obtusus, glaber, 3 mm. longus, minute denticulatus. Corolla tenuissime furfuracea, fere 1 cm. lata, segmentis patulis. Antherae ciliatae, 1 mm. longae. Flores feminei solitarii. Pedunculus fructiferus filiformis, 2–6 cm. longus. Fructus ovoideus, 3.5–4 cm. longus, 2.5 cm. crassus. Semina pallida, ovata, 3.5–4 mm. longa, 2–2.5 mm. lata. Species *M. scabrae* Naud. (Cogn. in DC. Monogr. Phan. III, 582) proxima.—Masagua, alt. 400 feet, April, 1890, J. D. S. (Ex Pl. cit. 2203).

Var. *β.* **hirtella** Cogn.—Rami sparse hirtelli. Petiolus densiuscule hirtellus, 3–7 cm. longus. Folia ambitu late ovata, plus minusve lobata, apice saepius obtusa.—Escuintla, alt. 1100 feet, March, 1890, J. D. S. (Ex Pl. cit. 2206).

Var. *γ.* **rotundifolia** Cogn. Rami petiolique ut in typo. Folia ambitu suborbicularia, saepius satis profunde 5-lobata, lobis apice rotundatis.—San Luis, Dept. Escuintla, alt. 1,000 feet, Mch. 1890, J. D. S. (Ex Pl. cit. 2,208).

Anguria oblongifolia Cogn.; tota glaberrima; foliis breviter petiolatis, integris, oblongis, vix acuminatis, basi acutis, regulariter penninervis; floribus parvis, sessilibus, ad apicem pedunculi communis capitatis; antheris rectis, oblongis, tubo calycis paulo brevioribus, appendice vix perspicua leviter papillosa coronatis.—Rami graciles, laeves, simplices, elongati, striati. Petiolus gracilis, 2–3 cm. longus. Folia tenuiter membranacea, laete viridia, utrinque laevia, margine integerrima vel vix undulata, 10–13 cm. longa, 5–6 cm. lata; nervi tenues, subtus vix prominentes. Cirrhi graciles, longiusculi, tenuiter striati. Pedunculus communis masculus gracilis, 2.5 dm. longus, apice 8–10-florus. Calycis tubus anguste oblongus, basi rotundatus superne satis constrictus, teretiusculus, 8 mm. longus; dentes lanceolato-lineares, erecto-patuli, 1 mm. longi. Petala suborbicularia, uninervia, extus tenuiter furfuracea, 3 mm. longa. Antherae 5 mm. longae, 1.5 mm. latae. Flores feminei et fructus ignoti. Species *A. longipedunculatæ* Cogn. (Monogr. Phan. III, 673) proxima.—Rio Dulce, Dept. Livingston, sea level, Mch. 1889, J. D. S. (Ex Pl. cit. 1510).

Anguria diversifolia Cogn. (§ V. ANTHERAE MUTICAE); tota glaberrima; foliis breviter petiolatis, simplicibus, trinerviis, modo integris vel vix trilobatis anguste ovatis acutis basi oblique subtruncatis, modo fere usque ad basim tripartitis segmentis lanceolatis breviter acuminatis inferne contrictis; floribus parvis, sessilibus, ad apicem pedunculi communis breviter spicatis subcapitatis; antheris oblongis, rectis, muticis.—Rami satis graciles, laeves, sulcati, paulo ramulosi. Petiolus gracilis, 1–2.5 cm. longus. Folia membranacea, laete viridia, utrinque laevia, margine integerrima, 8–14 cm. longi; nervi crassiusculi, subtus leviter prominentes. Cirrhi crassiusculi, elongati, inferne sulcati. Pedunculus communis masculus robustiusculus, sulcatus, 2–3.5 dm. longus, apice 10–25-florus. Calycis tubus anguste oblongus, basi subacutus, superne valde constrictus, teretiusculus, 10–11 mm. longus; dentes lineares, erecto-patuli, 2 mm. longi. Petala obovata, extus dense furfuracea, 5–6 mm. longa. Antherae 4–5 mm. longae, 1.5 latae. Flores feminei et fructus ignoti.—Pansamalá, alt. 3,800 feet, November, 1888, v. Türckheim (Ex Pl. cit. 1414.)

Gurania Donnell-Smithii Cogn.; foliis ambitu suborbicularis, basi profunde emarginatis, usque ultra medium trilobatis, lobis anguste ovatis, abrupte longiuscule angusteque acuminatis; calycis tubo breviusculo, ovoideo, tomentoso-cinereo, segmentis subulatis, uninerviis, rubrocinereis, utrinque densiuscule breviterque puberulis, tubo duplo longioribus; antheris late-oblongis, inferne replicatis, connectivo lato, apice appendiculato.—Rami robusti, sulcati, densiusculi et breviuscule hirtelli. Petiolus robustus, striatus, longiuscule denseque villosus, 8–10 cm. longus. Folia membranacea, utrinque breviuscule sparseque pilosa praecipue subtus ad nervos, supra intense viridia, subtus satis pallidiora, margine remote spinuloso-denticulata, 2.5 dm. longa lataque; lobi exteriores paulo breviores, terminalis basi satis constrictus; nervi robusti, utrinque paulo prominentes, duo laterales basilares trifurcati, imum sinum marginantes; sinus basilaris 5 cm. profundus. Cirrhi robusti, sulcati, breviusculi villosi. Pedunculus communis masculus robustus, striatus, densiuscule breviterque villosus, 3.5–4 dm. longus, apice 30–40-florus; flores subsessiles. Calycis tubus 8–10 mm. longus, 6–7 mm. latus; lobi erecti, 1.5–2 cm. longi. Petala conniventia, linearia, acutiuscula, extus furfuracea, 6–7 mm. longa, vix 1 mm. lata. Antherae 5 mm. longae, 2 mm. latae, connectivo glabro, apice in appendicem papillosam 1 mm. longam producto. Flores feminei et fructus ignoti. Species *G. Levyanae* Cogn. (l. c. 686) proxima.—Rio Chactá, Dept. Alta Verapaz. alt. 2.500 feet, April 1889, J. D. S. (Ex Pl. cit. 1511.)

Sicyos longisepalus Cogn. (§ EUSICYOS) ; foliis longiuscule petiolatis, ambitu cordato-ovatis, angulato 5-lobatis, utrinque punctato-scabris, lobis triangularibus, nervis lateralibus imum sinum non marginantibus; cirrhis bifidis; racemis masculis simplicibus, 8–20-floris, folio longioribus; calycis dentibus elongatis; pedunculis femineis apice 3–4-floris; fructu ovoideo, satis compresso, acuto vel obtusiusculo, vix puberulo et setis elongatis persistentibus subsparse vestito.—Rami graciles, sulcati, subglabri. Petiolus robustiusculus, striatus, brevissime puberulus, 3–7 cm. longus. Folia tenuiter membranacea, intense viridia, margine remote vix denticulata, 8–12 cm. longa, 7–10 cm. lata, lobis lateralibus brevibus, acutiusculis, terminali majore, acutissimo; nervi vix prominentes, supra vix puberuli; sinus basilaris acutus, 1–3 cm. profundus. Cirrhi robustiusculi, elongati, striati, glabrati. Pedunculus communis masculus gracilis, striatus, brevissime puberulus, 1–2.5dm. longus, superne vel fere usque ad medium floriferus; pedicelli filiformes, demum reflexi, 5–10 mm. longi. Calycis tubus subrotatus, vix puberulus, 5 mm. latus; dentes patuli, lineari-subulati, 4 mm. longi. Corolla spureo-alba, vix puberula, segmentis patulis, late ovato-triangularibus, obtusiusculis, 5–7 nerviis, 4 mm. longis. Pedunculus fructiferus 3 cm. longus. Fructus basi rotundatus, 8–10 mm. longus; setae 3–6 mm. longae. Species

S. Deppei G. Don (Cogn. l. c. 876) proxima.—Antigua, Dept. Zacatepequez, alt. 5,000 feet, April, 1890, J. D. S. (Ex Pl. cit. 2202.)

Cephaelis glomerulata (§ CEPHAELIDEÆ Muell. Arg. in Fl. Brasil.)—Dichotomous, glabrous: stipules solitary, triangular-truncate, apex fimbriate: leaves oval-lanceolate (4–5 × 1½–2 in.), acuminate, base acute, patent secondary nerves about 14 uniting in marginal arches: heads of bracteose glomerules subsessile, semi-globose (9 lines high, 1 in. broad); bracts coriaceous, pallid, margin virescent or violaceous, the 6–8 exterior oblate-roundish, of glomerules obovate passing into shorter spatulate membranaceous conduplicate bractlets: calyx scarious (1½ line), two-thirds free, unequally subulate-toothed: corolla white, half-exsert from bractlet, slender (6 lines), one-fourth-lobed, upper half cano-pubescent within: anthers (2 lines) exceeding filaments: bi-lobed disk equalling ovary; drupe ovoid (3 lines), sulcate, blue.—Shrub 3–4 ft. high with habit and leaves of *C. dichotoma* Rudge and *Psychotria Martiana* Muell. Arg., but differing from both by developed bractlets of glomerules and of flowers.—Swampy woods on Rio Dulce, sea-level, Mch. 1889, J. D. S. (Ex Pl. cit. 1637).

EXPLANATION OF PLATE I.—Fig. 1, flowering branch. Fig. 2, head with all but one of the bracts removed. Fig. 3, glomerule. Fig. 4, exterior bract. Fig. 5, exterior bractlet. Fig. 6, interior bractlet. Fig. 7, stipule. Fig. 8, flower. Fig. 9, corolla of long-styled flower laid open. Fig. 10, vertical section of short-styled flower with corolla removed. Fig 11, drupe. (Figs. 1 and 2 are natural size; the others are variously magnified.)

LOBELIA LAXIFLORA H. B. K., VAR. **insignis**.—Glabrous in every part: stem simple, stout; 3–4 ft. high: leaves densely confert, linear-lanceolate (7 × 1 in.), sessile, glandular teeth appressed: peduncles bractless, nearly equalling leaves: flowers 2 in. long: calyx-segments one-fifth as long, linear, twice exceeding tube: corolla carinately nerved; tube half as broad as long, yellow varied with red; divisions of upper lip red on both sides; lower lip plicate, half as broad as long, yellow margined with red.—Mr. Hemsley refers to the type a plant collected by Salvin in similar locality. The congested large leaves and flowers impart a distinct habit.—Slopes of Volcan de Agua, alt. 10,000 feet, April, 1890, J. D. S. (Ex Pl. cit. 2173.)

MACLEANIA CORDATA Lemaire, var. **linearifolia.**—Leaves obscurely penninerved, above conspicuously reticulated, linear-lanceolate (4–5 × ½–¾ in.), regularly tapering from rounded base to acute mucronulate apex.—Pansamalá forest, alt. 4,000 feet, July 1887, v. Türckheim (Ex Pl. cit. 1332.)

ARCTOSTAPHYLOS PUNGENS H. B. K., *(not Gray)*, var. **cratericola.**— Younger parts and racemes puberulous: branchlets trigonal from stout short (1 line) petioles: leaves crowded, smooth and shining, punctate beneath, oval or obovate (6–7×4–5 lines), each end obtuse, apex callose: capituliform racemes scarcely equalling leaves, 4–6-flowered, coloured bracts exceeding abbreviated pedicels: filaments circularly dilated at middle, chiefly beardless; anthers nearly half as long, equalling short smooth awns: style exceeding stamens.—Tufted, with prostrate branches a foot or more long, on rocks in the crater of Volcan de Agua, alt. 12,000 feet, April 1890, J. D. S. (Ex Pl. cit. 2159.)

SOLANUM OLIVÆFORME, Botan. Gazette, XIV. 28, XV. 28.

EXPLANATION OF PLATE II.—Fig. 1, portion of a plant in flower. Fig. 2, portion of a plant in fruit. Fig. 3, vertical section of flower. Fig. 4, stamen. Fig. 5, pistil. Fig. 6, transverse section of fruit. Figs. 1 and 2 are natural size; the others are variously enlarged.

Daphnopsis Tuerckheimiana (§ NORDMANNIA Benth. et Hook.)—Epiphytal (?), dichotomous: petioles short, incrassate; leaves coriaceous, glabrous, ovate-lanceolate or lanceolate (3–5 in.), caudately produced, base acute, margin revolute, veins immersed: umbelliform staminate fascicles lateral and terminal, subsessile, bracteate, pilose, 5–7-flowered, pedicels short: perianth 5–6-times longer (3½–4 lines), clavate, smooth within, lobes one-fifth as long with alternate ones the broader: superior stamens partly exsert, interior inserted above middle of tube: abortive ovary hirsute, globose, equalling style, ovule manifest; stipe long as pistil (½ line); scales as long, united in cylindrical dentate sheath splitting variously: fertile flowers not seen.—Inflorescence apparently similar to that of a recent Brazilian species, *D. Sellowiana* Taubert, Bot. Jahrb. XII, Beibl. 7, which seems incorrectly referred to the section NEIVIRA Griseb.—Pansamalá forest, alt. 3,800 feet, Sept. 1886, v. Türckheim. (Ex Pl. cit. 1039.)

MYRIOCARPA LONGIPES Liebm., var. **Yzabalensis.**—Leaves round-oval, abruptly cuspidate, petioles from a third to nearly as long and like veins strigillose: branches of pistillate inflorescence 2–3, twice dichotomous, flowers sessile: achenia black and shining, scabrid with sparse short hairs: stigma conspicuous.—Shrub 6–8 ft. high, Monte Cachirulo, Dept. Yzabal, alt. 900 ft., Apr. 1890, J. D. S. (Ex Pl. cit. 1644).

Triuris brevistylis.—About 3 in. high, aphyllous: inflorescence uniparous, twice furcate, peduncles $\frac{1}{2}$–1 in. long, semi-amplexicaul bracts with rounded lobes at base: perianth-segments with twice longer appendages 3–4 lines long: styles pubescent, sub-terminal, capillary, deflexed, shorter than obtuse carpels of ovary; stigma oblique; fruit obovate, puberulous.—*T. diaphana* Miers, one-third as large, with cauline leaves, sheathing entire bracts, less developed inflorescence, is distinguished best by carpels elongated into terminal subulate styles.—On decayed trunks of trees, Pansamalá forest, alt. 3,800 feet, Sept. 1888, v. Türckheim (Ex Pl. cit. 1384).

NEPHRODIUM DUALE, described as new, BOT. GAZ., XV. 29, must be referred to *Aspidium ascendens* Hew., which in view of the distinctly reniform involucre of the present specimens may be better designated as *Nephrodium ascendens*. It has been known hitherto only from Jamaica.

Baltimore, Md.

On certain new or peculiar North American Hyphomycetes. I.

Oedocephalum, Rhopalomyces and Sigmoideomyces n. g.

ROLAND THAXTER.

(WITH PLATES III AND IV.)

The species included in the above genera, although the similarity in their general type of fructification may justify their association for convenience as imperfect forms, must be considered as representatives of several widely different groups of so-called perfect fungi. Although in the plant subsequently described as a new genus there is at present no indication of any definite relationship to some higher form, there exists in the case of Rhopalomyces a probable connection with the Zygomycetes, as has been suggested by Van Tieghem,[1] while in Oedocephalum, a somewhat heterogeneous collection of species, we must accept the studies of Vuillemin and Brefeld as proving a connection both with the Discomycetes and the Basidiomycetes. The first named author[1] in his cultures of a Peziza, which he calls *Aleuria asterigma* has clearly established its connection with an Oedocephalum (*O. fimetarium* Riess) found growing in company with it and also developed directly from germinating ascospores. Brefeld,[2] on the other hand, in cultivating the basidiospores of *Polyporus annosus*, in nutrient solutions, has obtained from them a hyphomycetous fungus which, although it is compared to Aspergillus in the text, and is subject to unusual variations when artificially cultivated, is in all essentials an Oedocephalum, and not referable to any other described genus.

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[1] Bull. d. l. Soc. Bot. d. France, 1886, p. 494.

No such proof of the connection of Rhopalomyces with the Zygomycetes has as yet been obtained ; but its Syncephalis-like habit and mode of growth, together with the occurrence of supposed acroconidia, which have been observed by Van Tieghem and are similar to those which accompany the species of Syncephalis and Mortierella, give force to this supposition.

Costantin,[3] in his excellent synopsis of the simple Mucedines and elsewhere,[4] first clearly distinguished Rhopalomyces from Oedocephalum, restricting the former genus to a small number of species all characterized by the extreme differentiation existing between the fertile and the sterile hyphae ; the almost complete absence of septa, and the large dark-colored conidia. The presence of areolations upon the surface of the fertile head was formerly considered as distinctive of Rhopalomyces, and this definition is adhered to by Saccardo in the Sylloge,[5] although the same character is, as was pointed out by Harz in his well known paper,[6] distinctly present in so typical a species as *Oedocephalum glomerulosum*. It may be mentioned that the last named author recognized neither Oedocephalum nor Rhopalomyces as distinct genera, referring both to *Haplotrichum* Lk. emended to receive them: an error which becomes manifest in the light of a more extended knowledge of existing forms.

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[1] Sur le Polymorphism des Pezizes: Ass. Franc. p. l'Avan. d. Sci., Congres d. Nancy, 1886.

[2] Untersuchungen, VIII Heft, Basidiomyceten III, p. 169, Taf. X, XI.

[3] Les Mucedinees Simples. Materiaux p. l'Histoire d. Champignons. (Paris, 1888) Vol. II., p. 37.

[4] Bull. d. l. Soc. Bot. d. France, 1886, p. 492.

[5] Sylloge Fungcrum, Vol. IV., p. 50.

[6] Einige Neue Hyphomyceten Berlin's und Wien's. p 120, Plate I, fig. 1 c. d.

In enumerating the American species of these two genera, the writer has therefore restricted Rhopalomyces as above defined, referring to Oedocephalum those species which are characterized by the presence of fertile hyphae nearly approaching the sterile in size or at least not supplied with rhizoid-like basal outgrowths for support, and as a rule, distinctly septate.

The forms at present recorded from this country appear to be confined to two species, *Rhopalomyces cucurbitarum* Rav. and *R. cervinus* Cke. In Europe, however, the number described is considerable, although the identification of many of them is beset by the difficulties which are usually associated with wretched figures, or diagnoses without measurements or mention of allied species for purposes of comparison. Since it is often somewhat difficult to form any opinion concerning them from the description alone, a brief synopsis of all described forms is here appended, which may perhaps be found of value in this connection :

Oedocephalum PREUSS.

OEDOCEPHALUM GLOMERULOSUM (Bull.) Sacc. Plate IV, fig. 1.

Oedocephalum glomerulosum Saccardo, Sylloge Fungorum, Vol. IV., p. 47. Costantin : Les Mucedinees Simples, p. 39, fig. 6. Berlese, Fungi Moricoli, III., N. 2, fig. 1-5.

Mucor glomerulosus Bulliard : Herbier d. l. France, Pl. 504, fig. 3.

Haplotrichum glomerulosum Harz : Einige Neue Hyphomyceten Berlin's und Wien's, p. 120, Taf. 1, fig. 1. Saccardo : Fungi Italici, Pl. 804.

Haplotrichum roseum Corda : Prachtflora, p. 23, Taf. XI. Icones Fung. II., Taf. 2, fig. 28.

Varying in color from nearly white to rose colored or yellowish. Sterile hyphae creeping, much branched and septate, about 6μ in diam. Fertile hyphae erect, solitary, tapering slightly upwards, septate, 8–9μ in diam. 200–350μ in height. Sporiferous heads spherical to obovoid, 35–50×25–45μ : average 30×38μ; often distinctly areolate. Spores oblong to obovoid, slightly pointed at the base and broader at the distal end, 9×18μ, maximum 10×30μ.

On old paper, decaying vegetable matter, dung of various animals. Massachusetts, Connecticut.

This species occurs very commonly on a great variety of substrata and is often troublesome in laboratory cultures, completely occupying them to the exclusion of other and perhaps more desirable fungi. It varies from a decided rose or flesh color, which it often imparts to the substratum on which it grows, to pale whitish or yellowish : the color depending, in part at least, upon the amount of light to which it is exposed, and to the character of the substratum. The simple fertile hyphae also vary greatly in length and in the number of the septa, which may be almost wholly wanting. The areolation of the heads is distinct or otherwise, according to their condition of maturity, as well as to the illumination used in examining them.

In view of the observations of Vuillemin in connection with his *Aleuria asterigma* already referred to, it may be of interest to note that in several cultures made by the writer, that had been allowed to run for several weeks, there appeared repeatedly at various points on the old paper on which the fungus grew luxuriantly, a number of small Pezizae, flesh colored or whitish, about six millimeters in diameter and apparently developed from the same mycelium which gave rise to the Oedocephalum. Although asci were produced, no ascospores matured in them, so that cultures were impossible and no proof of the connection between the two forms was obtainable.

Saccardo in the Sylloge follows Harz in considering *O. elegans* Preuss a synonym of this species. The description and figure of *elegans*, however, which is given in Sturm, seem to indicate that the two are quite distinct: Preuss' species resembling *O. pallidum* (B. & Br.) in many respects. Whether Harz is correct in assuming that the present species is synonymous also with *O. album* and *O. alienum* of Preuss must remain uncertain, since these two species are hardly recognizable from either the figures or descriptions. The spherical spores described by Preuss, however, seem to separate both from *glomerulosum*, and Saccardo is doubtless right in keeping them distinct.

The *Oedocephalum roseum* Cooke, judging by the description and figure in Grevillea, can hardly be separated from the present species, of which it may be merely a short-stemmed variety.

Oedocephalum echinulatum n. sp.—Plate IV, figs. 8–11.

White becoming slightly yellowish. Sterile and fertile hyphae not clearly differentiated, the latter more or less irregularly and indefinitely branched. Fertile heads nearly spherical to obovoid, very variable in size, more or less distinctly areolate: maximum 45×65μ: average 28×35μ. Spores oval to elliptical, finely echinulate: average 10×12μ; maximum 18×25μ.

On cheese and cheesy paper. Massachusetts.

This species, which made its appearance in company with several Mucors on a laboratory culture, is readily distinguished by its finely echinulate spores and very irregular growth. It resembles *O. dichotomum* Preuss in the successive branching of the fertile hyphae; but the type is not dichotomous, new heads usually arising by an out-growth from a point below the last head formed as in fig. 8. In some of its irregularities it approaches the conidial form of *Heterobasidion annosum* Bref. previously referred to, especially in the common occurrence of compound proliferation from the fertile heads, either before or after they have produced spores; each proliferation in its turn producing a smaller head and smaller spores as in fig. 9.

Oedocephalum verticillatum n. sp.—Plate IV, figs. 12–14.

White, becoming faintly yellowish. Sterile hyphae creeping, frequently septate, sub-verticillately branched. Fertile hyphae arising in whorls of from one to five; septate; 4μ in diam., tapering very slightly before swelling suddenly into the sporiferous head. Head invariably spherical; very faintly areolate; 20–25μ in diam. Spores muriculate, spherical, slightly irregular in outline, 5–7μ in diam.

On newt's dung. E. Tennessee.

This delicate species covers the substance on which it grows with an extremely evanescent mycelium; the hyphae running from one projecting point of the substratum to another and producing the fertile branches in the interval. The latter, therefore, arising in whorls in a usually vertical plane, are not always erect, some pointing downwards or outwards as well as upwards. The species does not appear nearly related to any of the described forms, from all of which it is readily separated by its verticillate habit and spherical muriculate spores.

OEDOCEPHALUM PALLIDUM (B. & Br.) Cost., Plate IV, figs. 2–7.

Oedocephalum pallidum Costantin Bull. Bot. Soc. d. France, Vol. XXXIII, p. 492.

Rhopalomyces pallidus Berkeley & Broome, Annals and Mag. of Nat. Hist., 2d Ser., Vol. VII, p. 96, No. 504, Plate V, fig. 2.

Rhopalomyces candidus Berkeley & Broome, l. c. p., 96, No. 505, Pl. V, fig. 3.

Haplotrichum fimetarium Riess in Fresenius Beitr. z. Mycol., III, p. 105, Taf. XIII, figs. 59–65.

Oedocephalum fimetarium Saccardo, Sylloge Fung., IV, p. 48.

Rhopalomyces cervinus Cooke, Grevillea, Vol. XII, p. 27. Ravenel, Fung. Amer., 574. Ellis N. A. F., No. 658.

Aleuria asterigma Vuillemin Ass. Franc. p. l'Avan. d. Sci. Congrès d. Nancy, Aug. 1886, Vol. XV. Pl. X.

Clear white, becoming brownish yellow to fawn-colored. Sterile hyphae creeping, septate: fertile hyphae erect, simple or once dichotomously branched. Fertile heads nearly spherical to obovoid, more or less distinctly areolate, $20–30\mu$ in diameter. Spores oval or elliptical, sometimes slightly roughened toward the apex, $6–10 \times 4–16\mu$.

On old paper, decaying wood, dung of various animals, etc. Mass., Conn., N. Carolina, Europe.

This species occurs very commonly on laboratory cultures as well as old paper in refuse heaps. In one instance only I have found it covering the under side of a charred and decaying log in shady woods, with its fawn-colored fructification. The form on dung which corresponds to the *Haplotrichum fimetarium* of Riess, is usually smaller than the others, as far as I have observed, the spores not often reaching the length (10.7μ) given by Fresenius; and usually measuring about 8μ or less.

The synonymy of the species is somewhat confused, yet that given above is I believe correct. Through the kindness of Mr. Massee, to whom I am greatly indebted for sketches, with measurements of the types of *Rhopalomyces pallidus* and *candidus* B. & Br., the identity of these two supposed species is established beyond question, *R. candidus* having been based upon the different appearance which distinguishes immature from the mature individuals of *R. pallidus*. Again, *Haplotrichum fimetarium* Riess is separated by Fresenius from *R. pallidus* merely on the ground that its head showed no areolation. Since, however, this character is quite unreliable, being distinct or invisible, according to the condition of the head when examined, it cannot possibly be considered as a valid reason for keeping the two distinct. As a matter of fact the heads of the form on dung are often distinctly areolate. As Costantin has pointed out[1], the conidial form associated with Vuillemin's "*Aleuria asterigma*" must also be added to the list. *Rhopalomyces cervinus* Cooke, as distributed in Ellis N. A. Fungi, No. 658, by Ravenel, and therefore presumably authentic, is identical with the common form on dung, and the diagnosis in Grevillea also mentions no point of difference. Whether *O. elegans* Preuss may not be the same, must necessarily remain in doubt, although the figures and description in Sturm's Flora apply quite well to the present species, and are sufficiently definite at least to distinguish it with certainty from *O. glomerulosum.*

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[1] Les Mucedinees Simples, p. 39.

Rhopalomyces CORDA.

RHOPALOMYCES ELEGANS Corda.—Plate III, figs. 1–2.

Rhopalomyces elegans Corda Prachtflora, p. 3, Taf. 2. Anleit. z. Stud. d. Mycol. p. LXVI, Taf. B. 20, figs. 1–3. Fresenius Beiträge z. Mycol. I, p. 19, Taf. III, figs. 9–15. Bonorden Handbuch d. Allg. Mycol, p. 113, Taf. IX, fig. 184.

Haplotrichum elegans Harz: Einige neue Hyph. Berl. u. Wien's p. 118, Taf. V, fig. 5.

Sterile hyphae creeping, much branched, very rarely septate, 3–4 μ in diam. Fertile hyphae erect, more or less gregarious, colorless or slightly tinted, supported by rhizoids at the base which is usually slightly swollen, nearly cylindrical or tapering towards the apex, 1.5–0.75 mm. high, 18 μ in diam. Head nearly spherical, usually distinctly areolate, 50–80 μ in diam. Spores about 100 in number, dark-brown, ovoid to sub-cylindrical, slightly pointed at the base, 35–55 $\times$ 11–22μ.

On vegetable and animal matter of various kinds; bones, dung of animals, potatoes, squash rind, etc. Connecticut.

This well known species has occurred very frequently at New Haven on a variety of substances, although it is cultivated with difficulty, and I have been unable to induce the spores to germinate even in nutrient solutions. The spores vary considerably in size and shape and are usually nearly oval or long oval, seldom presenting the very elongate almost cylindrical form figured by Corda.

The supposed acroconidia described by Van Tieghem and resembling the similar productions of Morthierella and Syncephalis I have never seen.

RHOPALOMYCES CUCURBITARUM Berk. & Rav.

Rhopalomyces cucurbitarum Berkeley & Ravenel, Grevillea, Vol. III, p. 109.

"Hyalinus; floccis inarticulatis; capitulis globosis echinulatis: sporis obovatis ovatisque."

On putrid squashes, Lower Carolina.

The exhaustive diagnosis above quoted has led to some uncertainty concerning this form, which, however appears to be a true Rhopalomyces and probably a distinct species.

Mr. Massee has kindly sent me a sketch from Berkeley's type with measurements which show that it is perhaps too closely allied to *R. elegans*, differing chiefly in its much smaller size. The creeping mycelium consists of the usual fine aseptate hyphae, from which the large, erect, fertile hyphae arise. The spores are represented as reddish brown, ovoid, slightly pointed at the base, and the head as spherical. The following measurements are noted: fertile hyphae 170–200μ high by 10–12μ in diam.: head 40–50μ in diam.: spores 18–20 × 9–10μ. It will be observed that these measurements hardly come within the limit of variation which *R, elegans* may be supposed to exhibit, and it is therefore necessary to consider the species distinct until more information concerning it can be obtained.

Rhopalomyces strangulatus n. sp.—Plate III, figs. 3–9.

Sterile hyphae copious, much branched and rarely septate, 4μ in diam. Fertile hyphae densely gregarious, supported by numerous rhizoids, pure white, cylindrical, 2–8 mm. high, (average 7.5 mm.) by 40–50μ in diam., suddenly constricted below the head with which it is connected by a narrow neck 8μ in diam. Head perfectly spherical, more or less distinctly areolate, beset with very numerous projections; average diam. 250μ. Spores, several hundred in number, subcylindrical; rounded at both ends, average dimensions 39 × 8.5–10μ.

On old bones and other decaying animal matter.— Massachusetts, Connecticut.

This remarkable species, which is the prince of its kind and one of the most beautiful of the Hyphomycetes seems to be not uncommon about New Haven, growing with great luxuriance on old bones, etc. in woods, appearing after rains in patches of considerable size, at first sight not unlike a vigorous growth of some large Mucor. A few specimens of the same species once followed a culture of Basidiobolus on frogs dung in Cambridge: but, like *R. elegans*, I have been unable to cultivate it on a large scale except on substrata where its mycelium was already growing, and all sowing and attempted cultures of its spores in water or in nutrient solutions have failed entirely.

The *R. nigripes* of Constantin which occurs upon *Peziza arenaria* approaches it in bearing a large number of spores: but is at once distinguished by its smaller size, dark color and by the absence of the peculiar constriction below the head present in our species.

Sigmoideomyces n. gen.

Fertile hyhae erect. septate, growing in sigmoid curves, intricately branched, the main branches subdichotomous or falsely dichotomous, the ultimate branches sterile. Spores solitary, thick walled, borne on the surface of spherical heads. Heads borne at the apex of short lateral branches which arise from opposite sides of certain cells in the continuity of the hyphae.

Sigmoideomyces dispiroides n. sp.—Plate IV, figs. 15–18.

Fertile hyphae forming brownish yellow tufts about 1 mm. high, coherent through the interlocking of the numerous curved branches, the main axis (and its principal branches) growing in a more or less regular succession of sigmoid curves, giving off the main branches from the convex side of each curve, the cell which bears the branch also producing a short, nearly cylindrical, lateral outgrowth from either side, in a plane at right angles to that of the branch. Each of these outgrowths is septate near its base and apex and terminated by a perfectly spherical head. Ultimate branches curved and sterile, sometimes greatly elongated, giving rise to a succession of still smaller curved sterile branches from their convex sides. Heads 38μ (35–45μ) in diameter. Spores broadly elliptical to nearly spherical, yellowish, finely echinulate, $16 \times 17\mu$.

On rotten wood. Burbank, E. Tennessee.

A single specimen of this peculiar plant was collected at Burbank on the under side of a moist log on which it produced a few scattered tufts of varying size. The fungus had reached maturity, and owing to the fact that it separates with great readiness at the septa, it was impossible to determine whether the fertile hyphae were produced from a few fine filaments which could be seen running upon the wood at the base of some of the specimens examined, or whether the sterile hyphae had wholly disappeared. The heads also break off when mature, even while the spores are still *in situ*, carrying with them the last cell of the short stalk which bears them. A certain number of the ultimate sterile branches are continued into sometimes greatly elongated simple septate filaments which may be seen with a hand lens projecting here and there beyond the general surface of the tuft.

The genus bears much the same relation to Oedocephalum that Dispira bears to Aspergillus, and the somewhat similar type of growth and branching seen in VanTieghem's species has suggested the specific name.

SYNOPSIS OF THE DESCRIBED SPECIES OF OEDOCEPHALUM AND RHOPALOMYCES.

Oedocephalum albidum Saccardo: Michelia, II., p. 288, (*sub* Haplotrichum), Fungi Italici, plate 805. The hyphæ of this species are described as hyaline and figured as brownish; fertile simple, rarely branched. Spores spherical or broadly elliptical, 7–10μ in diam., yellowish. On roots of lemon.

O. album Preuss: Fung. Hoyersw., No. 108: Sturm's Flora, Taf. 63. This is referred to *O. glomerulosum* by Harz, but is figured with round spores. Otherwise the description and plate furnish no clue to its identity.

O. alienum Preuss: l. c., No. 109, l. c. Taf. 63. This species is said to be distinguished from the preceding by the fact that the head lacks the warts and furrows present in *O. album.* The spores are also figured as spherical and the species is otherwise equally unrecognizable.

O. aurantiacum Cooke: Grevillea, vol. V, p. 147. Forms orange colored orbicular patches. Hyphæ short, fasciculate, septate, hyaline, above spherical and papillate. Spores spherical, orange-colored, smooth, (no measurements). On leaves of forest trees, India.

O. badium Von Müggenberg; Myc. Beiter., in Verhand. d. k. k. zool. bot. Gesell. in Wien, 1874. The heads of this species are said to produce longish cells, which are covered with muricate brown spores $7 \times 10\mu$. It is therefore not an Oedocephalum.

O. byssinum Saccardo: Sylloge, IV., p. 49. Bonorden Abhand. a. d. Geb. d. Mycol. II., p. 95, Taf. 1, fig. 12, *sub* Periconia. Karsten Symb. a. Myc. Fenn., 1888, XXVI, 4. p. 49, subspecies *herbariorum.* Hyphæ hyaline, hardly septate. Spores spherical. Karsten's sub-species has spores perfectly spherical, verruculose 12–14μ in diam. Fertile hyphæ 2 mm. $\times 15 - 20\mu$. Heads becoming yellowish. The type seems very near *O. albidum* Sacc. from the description. On decaying leaves.

O. crystallinum Cesati. This is said by Saccardo to be described on "p. 299" of the Botan. Zeitung, and figured in Hedwigia, 1, Taf. IV. fig. 3. I have not seen the original description. On Taf. IV, Vol. II, of Hedwigia fig. 3 represents an Oedocephalum which might be *O. glomerulosum*, but it is too coarse and ill-drawn to give any idea of its identity. A tedious search in the accompanying text shows no reference to it. According to Saccardo, the spores are hyaline, oblong, ovoid, becoming subochraceous. On Sporidesmium: distributed in in Klotsch, Herb. Viv. Myc., 1974.

O. dichotomum Preuss: Fungi Hoyersw. No. 271. This is peculiar for its successively dichotomous branches, which terminate in a head bearing brownish, finely muriculate globoso-ellipsoid spores. On Polyporus flavus.

O. fimetarium Riess: see above sub *O. pallidum* (B. & Br.) Cost.

O. glomerulosum (Bulliard) Saccardo: see above.

O. hyalinum Saccardo: Sylloge IV, p. 49, Bonorden, Abh. a. d. Geb. d. Mycol. II, p. 95, Taf. I, fig. 11, *sub* Periconia. Hyphae colorless, hardly septate. Head yellowish. Conidia small, spherical, hyaline. On decayed leaves. This seems too near *O. albidum* Sacc. and *O. byssinum* (Bon.).

O. laeticolor Berkeley & Broome: Ann. & Mag. of Nat. Hist., May, 1865, 3d Ser., Vol. XV, p. 403, Pl. XIV, fig. 12. Brick red. Fertile hyphae simple. Spores figured as elliptical and verrucose; described as spherical, granular, 15–20μ long, with a basal appendage. On cow dung. The figures are coarse and indefinite, but the species seems quite distinct.

O. pyriforme Saccardo: Sylloge, p. 49, Bonorden Handl. d. Allg. Mycol., p. 113, Taf. IX., fig. 196, *sub* Periconia. The hyphae of this species are described as aseptate. The spores are spherical or oval (figured as echinulate or verruculose) slightly blackish, hyaline. The head is grey green, and the whole plant in gross appearance resembles Penicillium glaucum. On Polyporus flavus.

O. Preussii Saccardo: Sylloge, Vol. IV., p. 49, Preuss, Fung. Hoyersw., No. 104, *sub* Periconia alba. Hyphæ white, septate. Spores subglobose, smooth. This species can hardly be identified from the description. On decaying leaves.

O. roseum Cooke: Grevillea, Vol. I, p. 184, ibid Vol. II., Pl. 22, fig. 8. "Rose pink, effused, or in minute punctiform tufts collected together in irregular patches. Threads equal. Head subglobose: spores ovate or oval, smooth, attached by a slight apiculus. Cooke, Exs., No. 550. On old paper and rags." The description and figure corresponds closely with some varieties of *O. glomerulosum*.

O. sulphureum Cooke & Massee: Grevillea, Vol. XVII, p. 3. "Tufts hemispherical or confluent, sulphur colored. Threads septate, dichotomous, globosely capitulate at the apex, papillate, conidia globose, hyaline (3–5μ diam). Epispore smooth. On rope."

Rhopalomyces candidus Berkeley & Broome: see above sub *Oedocephalum pallidum* (B. & Br.) Cost.

R. cervinus Cooke: see above sub *Oed. pallidum* (B. & Br.)

R. cucurbitarum Berkeley & Ravenel: see above.

R. elegans Corda: see above.

R. nigripes Costantin: Bull d. l. Soc. Bot. d. France, 1886 p. 442. Les Mucéd. Simples, p. 37, fig 5.

Head and fertile hyphæ brown. Head 28–30μ in diam. Spores brown, elongate, rounded at one extremity, pointed at the other. 25–34×8–9μ. On Peziza arenaria.

R. pallidus Berkeley & Broome: see above sub *Oedocephalum pallidum*.

The writer desires to express his indebtedness to the kindness of Mr. Massee in communicating notes on Berkeley's types, as well as to Prof. Farlow, for the privilege of examining several of the works consulted.

New Haven, October, 1890.

EXPLANATION OF PLATE III.

Rhopalomyces elegans Corda.

Fig. 1. Single fertile hypha with rhizoids ×68. Fig. 2. Four spores ×464.

Rhopalomyces strangulatus, n. s.

Fig. 3. Fertile hyphæ natural size (as reduced.) Fig. 4. Fertile hypha ×68. Fig. 5. Fertile head mostly denuded of spores ×232. Fig. 6. Base of fertile hypha showing rhizoids ×232. Fig. 7. Five spores ×464. Figs. 8–9. Early stages in formation of fertile hyphæ ×232.

EXPLANATION OF PLATE IV.

Oedocephalum glomerulosum (Bull.) Sacc.

Fig. 1. Three spores ×696.

Oedocephalum pallidum (B. & Br.) Cost.

Fig, 2. Fertile head of form on dead wood ×464. Fig. 3. Abnormal spore production at apex of fertile hypha ×464. Fig, 4. Five spores of form on dead wood ×696. Fig. 5. Four spores of form on paper ×696. Fig. 6. Fertile hypha of form on horse dung (*O. fimetarium* Riess) × 464. Fig. 7. Five spores of form on horse dung ×696.

Oedocephalum echinulatum, n. s.

Fig. 8. Portions of fertile hyphæ showing inside of branching ×348. Fig. 9. Fertile head proliferating to form several secondary heads ×348. Fig. 10. Two fertile heads, one young, the other mature ×464. Fig. 11. Two spores ×696.

Oedocephalum verticillatum, n. s.

Fig. 12. Sterile and fertile hyphæ, showing verticillate habit ×232. Fig. 13. Single head ×464. Fig. 14. Three spores ×696.

Sigmiodeomyces dispiroides, n. g. et n. s.

Fig. 15. Fragment taken from a fertile tuft, showing sigmoid habit; fertile heads denuded of spores when they have not fallen off entirely ×136. Fig. 16. Fragment bearing two pairs of fertile heads, one of which has fallen off ×464. Fig. 17. Spore ×696. Fig. 18. Spore in optical section ×696.

BV 0020880

New Grasses.

GEO. VASEY.

Sporobolus pilosus, n. sp.—Perennial, from thick roots; whole plant pale green: culms cespitose, rigid, erect, about 1½ ft. high, leafy, particularly at the base, mostly simple, sheaths smooth, the uppermost sheathing the base of the panicle, the lower crowded and flattened; ligule inconspicuous; the throat, margin and both sides of the lower blades pilose, the upper ones involute and attenuated to a long point, shorter than the culm: panicle terminal, spike-like, 2 to 3 inches long, close, the lower part included in the sheath; spikelets 2½ lines long, smooth, the lower empty glume ¼ shorter than the upper, which equals the fl. gl. and palet, all obtuse.—Resembles S. asper, which has the leaves longer than the culm, both empty glumes shorter than the flower, and the leaves smooth or not pilose. Collected in Kansas, by B. B. Smythe.

Bouteloua uniflora, n. sp.—Perennial: culms 12 to 15 inches high, slender: culm leaves 4, the upper sheathing the base of the panicle, 1 line wide, the lower 3 to 4 inches long, rigid, becoming involute; ligule a ring of short hairs: panicle racemose-spicate, about 4 inches long, with 35 to 50 spikes, which are about 4 lines long, and but one flowered; lower empty glume linear-oblong, hardly half as long as the upper, which is between 3 and 4 lines long, acuminate, conduplicate, entire and scabrous on the midrib; flowering glume about

2½ lines long, and the palet about 1½ lines; sometimes a small, weak, threadlike sterile pedicel present, sometimes wanting: immediately below the flower is the rachis, which is linear and about two-thirds as long as the spikelet.—Collected in Texas, by G. C. Nealley, in 1890. Related to B. racemosa, but differs in its smaller size and smaller, one flowered spikes.

ANDROPOGON MACROURUS, var. **pumilus,** n. var.—Perennial dwarf, tufted; culms 6 to 10 inches high, branching from the base, and terminating in a cymose panicle; leaves 3 to 6 inches long, longer than the internodes, smooth, the sheaths enclosing the lateral flowering branches, sparingly hairy at the throat; branches numerous at the upper sheaths, each subdivided, the sheathing bract rather longer than the pair of terminal spikes, which are 1 to 1¼ inches long, and with 10 to 12 spikelets; pedicel slightly hairy below the bract.—A remarkable variety, collected in Western Texas by G. C. Nealley.

Department of Agriculture, Washington, D. C.

BRIEFER ARTICLES.

Actinella (Hymenoxis) Texana, n. sp.—A small slender annual 5 to 15 cm. high, branching at base; leaves mostly radical, 3-nerved, oblong and tapering at base, entire or few-toothed; those of the stem narrower and toothed, becoming linear and entire above: heads small (4 to 6 mm. high): involucral bracts in 2 series; the outer ones about 8, rigid and keeled, united at base: rays minute, not projecting beyond the bracts; achenes pyramidal, 1 mm. long: pappus of 5 oval paleæ with aristate acuminations very conspicuous in mature heads. Collected by F. W. Thurow, near Hockley, Texas, 1889 and 1890; also mounted on a sheet with *A. odorata* (No. 742) of Palmer's 1879–80 collection from S. W. Texas. This little plant is evidently an Actinella, although it differs widely from any known North American form. The minute rays, not noticeable to the naked eye, and hence easily overlooked, under the lens suggest a relationship to the rayless species of South America. As presented by Dr. Gray in the Synoptical Flora, there is nothing to keep our species out of the section *Hymenoxis.* The involucre is very similar to that of *A. Rusbyi*, but in other respects the plant is very different. The achenes and pappus are very similar to those of *A. linearifolia*, but the involucre is very different.—JOHN M. COULTER AND J. N. ROSE.

Anæsthetics and Transpiration.—Mr. C. P. Lommen finds that Jumelle's results regarding the influence of anæsthetics upon transpiration in green plants may be obtained quantitatively by the simple method of weighing on the analytical balance at intervals of a few hours. Sprigs of *Selaginella rupestris* Spring, were employed in a series of experiments, and the percentage of water lost under glass in darkness and in light, with and without ether, corresponded with Jumelle's general results as chronicled in the *Revue Generale de Botanique*, October, 1890. This affords a very simple and easy method of demonstrating the relation between transpiration and assimilation.—CONWAY MACMILLAN, *University of Minnesota.*

EDITORIAL.

Most advanced college students now-a-days are expected to secure some personal freedom of judgment by the independent investigation of a suitable subject. The larger part of such efforts do not rise to to the plane of an addition to recorded knowledge, but serve at the time to assist the student in his mental development. A strong student with the necessary preliminary training, however, may do work of scientific value, if it is properly planned and directed by the teacher in charge. But whether of value or not from the scientific point of view, if reasonable success is attained the work must be well outlined at the start, and to do this often taxes the teacher's resources. If he is interested in mycology, the natural tendency is to turn students into that line of work, if in embryological development, into that work, and so on. This secures the best assistance from the teacher, but does not always bring to light the pupil's special talents or aptitude where he is most likely to excel. An inability to successfully manage the delicate manipulations required for high class histological work, stands in the way of fair success for many students, and for several years past our laboratories have chiefly cultivated this field of research. The work outlined for the student should be adapted not only to his knowledge and maturity of judgment, but to his skill as a manipulator, and to do this the selection must be made through a wide range of topics. There is a field of research of absorbing interest, crowded with unsolved problems, and in which the use of the microscope can be largely dispensed with, hitherto much overlooked, and that is the physiology of movement in plants. The changes in position of leaves, stems and roots due to gravitation, heat, light, moisture and various internal agencies, and other similar subjects possess all the elements required for a good thesis. There are excellent grounds for the belief that vegetable physiology will soon claim as much attention from American universities as minute anatomy did a short time since. At any rate, here is a field to be kept in mind in deciding upon themes for independent investigation.

CURRENT LITERATURE.

A General Treatise upon Fungi.

The fungi have presented many obstacles to a satisfactory treatment within the compass of a single volume, among which are the very large number of diversified forms ranging through a long and intricate series, the obscure polymorphic nature of many of the species, the much reduced structure and curtailed life cycle due to dependence upon organic food supply, and imperfect knowledge of physiological and biological phenomena. Of the several divisions of the subject, systematic, morphological, biological and physiological, we have had more or less well written general accounts of each, decreasing in number and importance in the order named, except of the last. For a knowledge of the physiology of fungi the student has been obliged to hunt up the scattered papers in journals and society proceedings, and incidental references in works upon other subjects. A treatise, therefore, which gives a satisfactory survey of the whole subject of fungi, with the several parts duly apportioned, can not but meet with hearty welcome. Such a work is Zopf's recently published volume on the fungi in their morphological, physiological, biological and systematical relations.[1] The author is well known by his able works upon the lower forms of life and by his numerous important researches.

Of the 500 pages in the volume 115 are devoted to morphology, 110 to physiology, 56 to biology and 204 to classification and development. Upon opening to the first page one finds that the author proposes to include in the work only the true fungi (Eumycetes), and to exclude the bacteria (Schizomycetes) upon morphological grounds as well as of expediency. No mention is made of the slime-molds (Myxomycetes) except in a footnote where they are said to be animals and not plants. The author has given much attention to these outlying groups of organisms and published several monographs upon them, and their exclusion from the present work is indicative of a conservative course of treatment.

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[1] Zopf, Wilhelm.—Die Pilze in morphologischer, physiologischer, biologischer und systematischer Beziehung. pp. xii, 500. figs. 163. Roy. 8 vo. Breslau, Ed. Trewendt: 1890.—M. 18.

The morphological part comprises an account of the vegetative organs, organs of fructification including the mechanical contrivances for freeing the spores, the structure and formation of the cell, and its union into systems.

The physiological part opens with seventy pages upon the chemistry of the fungi, which contain a vast amount of information, as may be judged by the fact that there are nearly three hundred footnote references to literature. The part is continued in an account of respiration, development of heat and light, external forces influencing life processes, agents harmful to life, phenomena of movement such as heliotropism, hydrotropism, geotropism, rheotropism, movements due to contact and to chemical and electrical stimuli, and finally nutation and hygroscopic movements.

The biological part treats of saprophytism and parasitism, the means of infection, effect of the parasite upon the host, symbiotism, and the enemies of fungi.

In the systematic part the following classification is used:

I. Phycomycetes
  a Chytridiaceæ (*Olpidiaceæ*, etc.)
  b Oomycetes (*Saprolegniaceæ*, *Peronosporeæ*, etc.)
  c Zygomycetes (*Mucoraceæ*, *Entomophthoraceæ*, etc.)
II. Mycomycetes
  a Basidiomycetes (*Tremellineæ*, *Polyporeæ*, *Agaricineæ*, *Lycoperdaceæ*, etc.)
  b Uredineæ.
  c Ustilagineæ.
  d Ascomycetes (*Saccharomycetes*, *Erysipheæ*, *Tuberaceæ*, *Sphærieæ*, *Pezizaceæ*, etc.)

The work is copiously illustrated with well drawn figures, which, however, are not so well engraved and printed as one would expect. A good index of illustrations and another of subjects closes the volume.

Altogether no work of equal importance has heretofore appeared on the general subject of fungi, and its speedy translation into English is much to be desired.

The Silva of North America.

North America has always been noted for its forests, and permanent record concerning them should be made before they have been more extensively devastated. The only work upon the subject, giving detailed descriptions, has been that of Michaux, supplemented by Nuttall, but this was necessarily incomplete. In the great work[1] now undertaken by Professor C. S. Sargent, the whole subject is to be presented in 12 quarto volumes, superbly printed and illustrated, the first of which has now appeared. Professor Sargent's connection with the forest volume of the 10th census is well known, and no one more competent could have been selected to undertake the work. That the plates will be all that can be desired is evidenced by the fact that the drawings are to be made by C. E. Faxon and engraved by Philibert and Eugène Picart. North American botanists are to be congratulated upon the appearance of this great work, and while its price will put it beyond many private purses, it should find its way into all public libraries, and should be considered a part of the equipment of every botanical department in our colleges. The definition of "trees" is a difficult one, and the author very rationally proposes to follow habit rather than size, a division which will include 422 species, besides numerous varieties. In nomenclature the rule adopted is to use the oldest generic name applied by Linnæus in the first edition of the "Genera Plantarum," published in 1737, or by any subsequent author, and the oldest specific name used by Linnæus in the first edition of the "Species Plantarum," published in 1753, or by any subsequent author, without regard to the fact that such a specific name may have been associated at first with a generic name improperly employed. Thirty-three species are included in this first volume.

Plants as rock-makers.

PLANTS have long been known to play an important part in the accumulation of travertine, though we doubt whether sufficient credit has been given to vegetation as a geological agent in this matter. In an elaborate memoir[2] by Walter H. Weed, forming part of the ninth annual report of the director of the U. S. Geological Survey, it is shown not only that very large deposits of travertine are due to the aid, direct and indirect, of vegetation, but also that the extensive deposits of siliceous sinter in the Yellowstone geyser region are in large part due to the separation of the silica from the water by plants.

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[1] SARGENT, CHARLES SPRAGUE.—The Silva of North America, a description of the trees that grow in N. Am. exclusive of Mexico, Vol. I. Magnoliaceæ–Ilicineæ pp. ix. 119, 50 plates, large 4to, Boston and New York: Houghton Mifflin & Co., 1891.—$25 per volume.

[2] WEED, WALTER HARVEY.—The formation of travertine and siliceous sinter by the vegetation of hot springs. pp. 619–676, 9th Ann. Rep't, U. S. G. S. figs. 5, pls. 10. Imperial 8vo. Washington: Government Printing Office, 1890.

Just how this elimination of silica is accomplished Mr. Weed does not say, and the matter really lies outside his province. Algæ are the chief agents in this work, and in the cooler waters at some distance from the springs mosses also assist. Cladothrix gypsophila, Mastigonema thermale, Leptothrix laminosa, and Leptothrix sp.? are the chief filamentous forms found growing in the hot waters. Various diatoms, Denticula valida in particular, eliminate silica from the tepid waters of the marshes about the Hot Springs, and their dead tests make up the bulk of the ooze which forms the soil of these marshes. The moss found in the warm waters was Hypnum aduncum var. gracilescens. The memoir is an interesting contribution to the knowledge of vegetation as a geological agent.

Minor Notices.

WITH THE APPEARANCE of Part V, devoted to Pteridophytes, Professor John Macoun's Catalogue of vascular Canadian Plants has been completed. It has been very handsomely done and the painstaking care so evident through it all has made it a mine of information concerning the Canadian flora. The present part brings up the generic numbers to 764, the specific to 3,054. A large appendix brings together additions and corrections to Parts I–IV, the results of all monographic work done since the beginning of the catalogue being included. It is promised that Part VI, soon to appear, will include Characeæ, Musci, and Hepaticæ, about 1,000 species in all. The part is rounded out by a complete index to all the parts, and the five will make a very complete and compact volume.

ALONG WITH the preceding comes a list of Canadian Hepaticæ, by Wm. Hy. Pearson, published in the same style, and containing 12 full page plates.

OPEN LETTERS.

The word "Biology."

An open letter from a "Prominent Zoologist" brings a breath of "*Bion*" into the October *Gazette*. In it, an original and characteristically unsearchable defence is proposed for the current etymological piracy *in re* the word "biology." It is probably the same "prominent zoologist"—if one may judge by kinship of orthographic recklessness—who presents, editorially, in the Nov. *American Naturalist* a similar sin against rational use of terminology. The argument perpetrated by the GAZETTE letter and perpetrated in the *Naturalist* editorial is as follows: "Zoologists were the first to study life; therefore they have a prior right to the word *biology*." The truly "biological" lapse in the major premise is not altogether unapparent to those who recall the fostering care of botanists—such as Darwin for example—while putting the infant industry of the zoologists on its feet. Why, even Huxley looks upon his long zoological training-course as a means of fitting him for extended study of the Gentians. An additional and quite unanswerable argument is brought forward, however, in the *Naturalist* editorial. "On a broad etymological basis the use of the word by zoologists is wrong," observes the writer. And then he straightway insists upon the right to use it. The peculiar appropriateness of an incorrect word for a one-sided, incorrect science is felt by us all. Indeed, as an additional evidence of true "biological" wrath at the philological pharisees and purists, the "prominent zoologist" proudly parades in his GAZETTE letter a Greek termination which we sincerely hope is not to be found elsewhere. At least the dictionaries, being written on the much despised "broad etymological basis" may be relied upon to exclude it.

Apparently the trouble with the prominent zoologist is this: In college days he was probably brought under the influence of Dr. Mark Hopkins, of venerated memory, and he has adopted one of the contestable *dicta* of his early philosophic mentor. It was a pleasing idiosyncrasy of Dr. Hopkins to insist that a "profound abyss" yawned between plants and animals. "Certainly," thinks the disciple. "'Life' characterises animals and, since there is the profound abyss I learned about, plants must be in a condition of partial paralysis and the biologist should shun them." This is what the editor of the *Naturalist* means when he speaks of the "living side" of the plant-world as if there was any side *not* alive. The same confused, altho Hopkinsesque, notions of plants and animals so characteristic of half-biologists, are shown again in the *Naturalist* editorial when it is said—"fully one-half of the teachers of botany are unable to give any of the living side of their subject. * * * The zoologist teaches *all that is taught* of life." The intimation is plain that the "living side" taught by the other half of the botanists is very different from the "life" (or in the *original* Greek *Bion*) which zoologists wish to claim as their peculiar province. A little less slavish knuckling down to the Mark Hopkins school, a little more Greek and a good deal more biology would make the "prominent zoologist" something of an orthographic authority.—AN OBSCURE AND ORDINARY BOTANIST.

Labeling specimens for the herbarium.

The usefulness of the herbarium is largely determined by the excellence of the labelling. Bearing this in mind, I cast about for a method of labelling the specimens in my herbarium, and, finally after having read of the methods used here and there and finding none that suited me exactly, I thought of the following way which has proved one of so great neatness, excellence, fulness and easeness as to lead me to mention it for the instruction of others who desire to render their collections more serviceable. In labelling my herbarium I used the printed names and descriptions clipped directly from the revised Manual. I labelled my shelves with the printed ordinal name, but could not use the descriptions. The genus covers have the generic name and description neatly pasted upon them. Each species paper has the generic initial and the specific name and description pasted upon it. This method virtually converts my herbarium into an invaluable *illustrated Gray's Manual*, and in my opinion is more handy than it would have been had I adopted the methods currently advocated.—WM. E. ANDREWS, *Blackburn University*, *Carlinville, Ill.*

NOTES AND NEWS.

MR. E. J. HILL is writing a series of articles for *Garden and Forest*, on the autumn flora of the Lake Michigan pine-barrens.

M. W. BEYERINCK has succeeded in isolating some of the very small algæ by a modification of the gelatine-plate process used by bacteriologists. Cf. *Bot. Zeit.*, 48, 725.

THE *Journal de Botanique* (Nov. 16), contains an account of the *Piperaceæ* of Ecuador, New Grenada, and Peru, in the collection of M. Ed. André, with descriptions of many new species, by M. C. De Candolle.

M. E. BOURQUELOT has examined the sugar in a large number of species of Boletus, as well as some Amanitas. He finds the sugar when the plants are young to be almost always tréhalose (2.7—7.8 per cent.), which is replaced with increasing age by mannite.

DR. THOMAS MORONG has returned from his long South American trip, and has been appointed curator of the herbarium of Columbia College. Mr. Morong is to be congratulated upon his successful trip, and upon the very congenial and fitting position that he found awaiting his return.

A VERY INTERESTING discovery of an arctic plant in Alpine regions, was made last summer by Professor M. A. Carleton, of Garfield University, Wichita, Kansas. *Douglasia arctica* Hook., known only from our northwestern arctic seashores, and poorly known even from that locality, was discovered on Pike's Peak, Colorado.

AN ELEVATION of temperature of 20° C., due to growth was observed by H. Devaux (*Bull. Soc. Bot. de France*, xxxvii, 168) in a pile of stored potatoes that had produced sprouts a foot or so long. The surrounding air indicated 18 to 19° C., the tubers on the outside of the pile 1 or 2 degrees higher, and at the center of the pile, 2 meters from the surface, the temperature stood at 39° C.

MM. SCHLOESING, JR. AND LAURENT have shown by a direct method that the Leguminosæ can fix free nitrogen. Instead of determining the amount of N in the seed and subsequently the amount in the crop, they measured the N, O, and CO_2 introduced into a chamber with growing plants. After three months they again determined these gases, when the N was found to have diminished. Every precaution seems to have been taken against error.

A CANADIAN Botanists' Correspondence association was formed in December last, composed of botanists who collect and preserve specimens of the Canadian flora, and who are willing to afford information and assistance to others in the study of botany. A variety of other good objects is set forth in their constitution, and the whole movement deserves hearty support and encouragement. The officers who constitute the executive of the association are John Dearness, London, Ontario, chairman, and J. A. Morton, Wingham, Ontario, secretary.

AT THE LEEDS meeting of the British Association, the subject of teaching botany in the schools was discussed. Professor Marshall Ward introduced it, and in the discussion that followed it was evident that British botanists are becoming aroused to the attitude that their American brethren have held for many a long day. They agreed "that it is time to leave the blind worship of facts, and instead of measuring a scholar's progress by the amount of dogmatic information imbibed and put into an examination paper, to look to his understanding of the relation between facts and the intelligence with which he describes what he sees." We had imagined that any sentiment contrary to this had gone out with the coming in of laboratory methods.

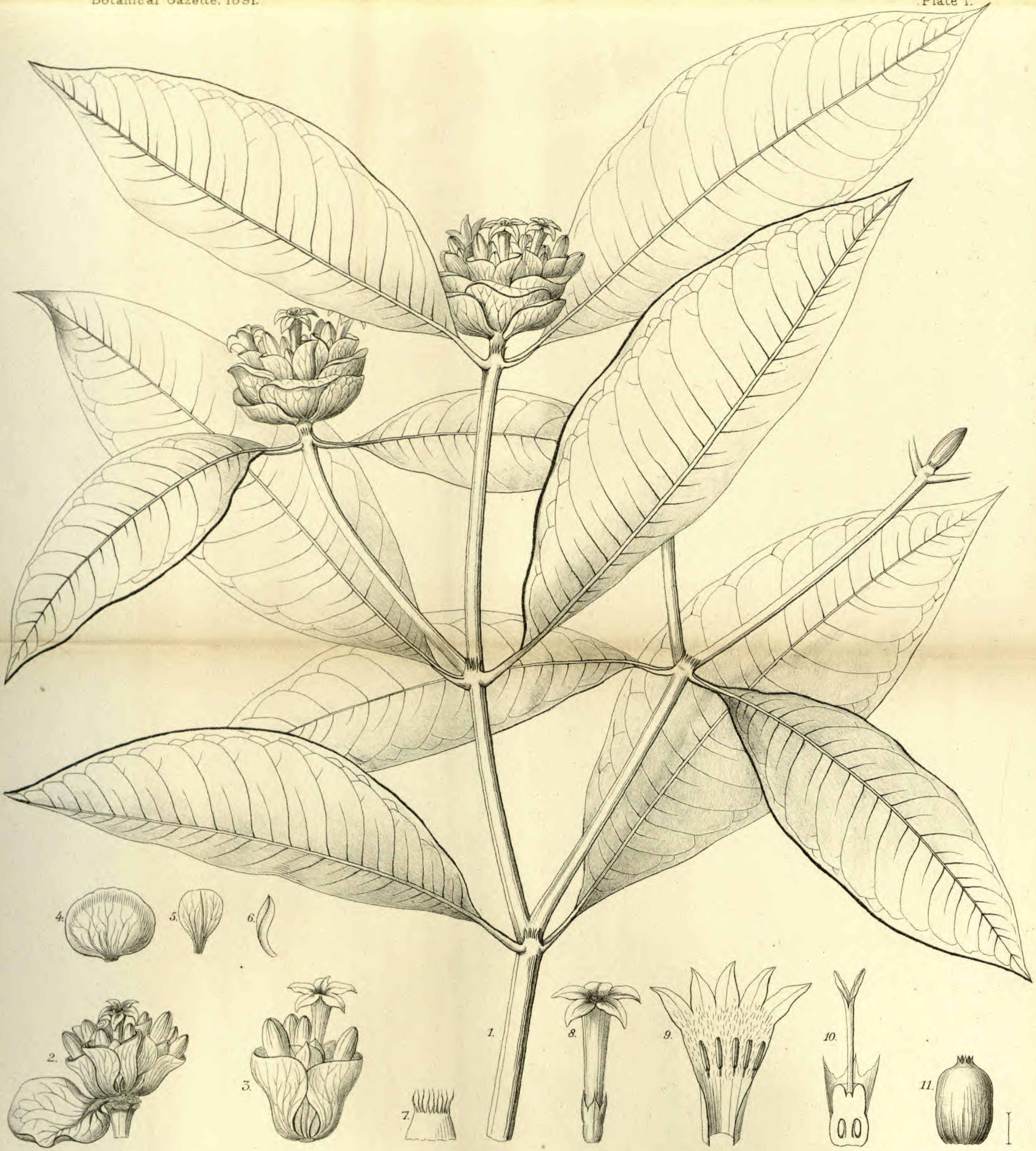
VINCENT CHMIELEWSKY has reëxamined the behavior of Spirogyra in conjugation, and particularly the changes in the formation and growth of the zygospore. He finds that the protoplasm of the male cell acts only as a vehicle for the transportation of the nucleus, the essence of the act of fertilization being the union of the male and female nuclei. The chlorophyll band or bands, pyrenoids, etc., instead of uniting with the corresponding structures of the female cell, as has been believed, become disorganized. Traces of these disorganized parts remain in the zygospore even till germination. Only the persistent structures of the female cell enter the tube which is formed on the germination of the zygospore. These observations, while differing very materially from those of other observers, coincide more closely with what we know of fertilization in other plants.

IN THE LAST *Bulletin of the Torrey Botanical Club* (Dec.) Dr. N. L. Britton presents his third contribution entitled, "New or Noteworthy N. Am. Phanerogams." *Ranunculus Porteri* is a new species from Henry's Fork, collected some years ago by the Hayden survey. The somewhat unsatisfactory label reads very much as though the plant had been collected in 1872, when J. M. Coulter was the collector. *Capsella divaricata* Walp. is thought to be identical with the Old World *C. procumbens* L.; it is suggested that *Hypericum Canadense* L., var. *majus* Gray is worthy of specific rank; *Calandrinia pygmæa* Gray is made *C. Grayi* Britt. on account of an earlier Australian species bearing the former specific name; *Lotus Helleri* is a new species disentangled from *L. Americanus* Bisch. (*Hosackia Purshiana* Benth.); *Spiræa Virginiana* is a new species from W. Va.; and a new Cyperus from Key West is described.

THE PROCEEDINGS of the eleventh meeting of the Society for the Promotion of Agricultural Science, held last August in Indianapolis, have been distributed. The most notable botanical article in the volume is the index to the common names of grasses, compiled by Prof.

Lamson-Scribner. It covers eighteen pages, and appears very complete. The other botanical articles are short, and part are in abstract. They are as follows: Preliminary notes upon the rotting of potatoes, by T. J. Burrill; Scab of wheat heads, by Clarence M. Weed, describing a Fusisporium; Recent observations on black rot of the grape, and comparative test of copper preparations for black rot of the grape, by B. T. Galloway; Some fungus root diseases, by L. H. Pammel. The abstracts are: Forage problem of the plains, by C. E. Bessey; Rots of the sweet potato, by B. D. Halsted; Cucurbita an American genus, by E. L. Sturtevant; Some biographical factors in the nutrition of plants, by M. Miles.

THE INDIANA ACADEMY OF SCIENCES met at Indianapolis December 29–31. The botanical papers announced were as follows: *Stanley Coulter*, Preliminary note on the genus Polygonum, Aberrant fruit of Juglans nigra, Value of minute anatomy in plant classification; *D. T. McDougal*, Aberrant forms of Juglans nigra; *David M. Mottier*, Notes on the apical growth of liverworts, Notes on the germination of spores of Notothylas; *J. C. Arthur*, A remarkable oscillating movement of protoplasm in a Mucor, Accelerating germination by previous immersion of the seed in hot water; *Henry E. Seaton*, Notes on Guatemalan Compositæ; *E. M. Fisher*, Parasitic fungi of Indiana; *John Morgan*, Circulation of sap; *J. N. Rose*, Distribution of Peucedanum in N. Am., Plants collected by Dr. Palmer in Arizona in 1890; *D. H. Campbell*, Comparative structure of the roots of Osmunda and Botrychium, Notes on the prothallium of the Osmundaceæ; *H. L. Bolley*, Notes on a new Puccinia, On the manufacture of plant infusions for the culture of bacteria; *W. P. Shannon*, The occurrence of Veratrum Woodii in Decatur Co., Ind.; *Joseph H. Tudor*, Some features in the occurrence of Viola pedata, var. bicolor; *W. J. Spillman*, Preliminary list of Knox Co. plants, Introduction of noxious weeds; *Katherine E. Golden*, Weight of seed in relation to production; *John M. Coulter*, Biological surveys, The flora of Texas.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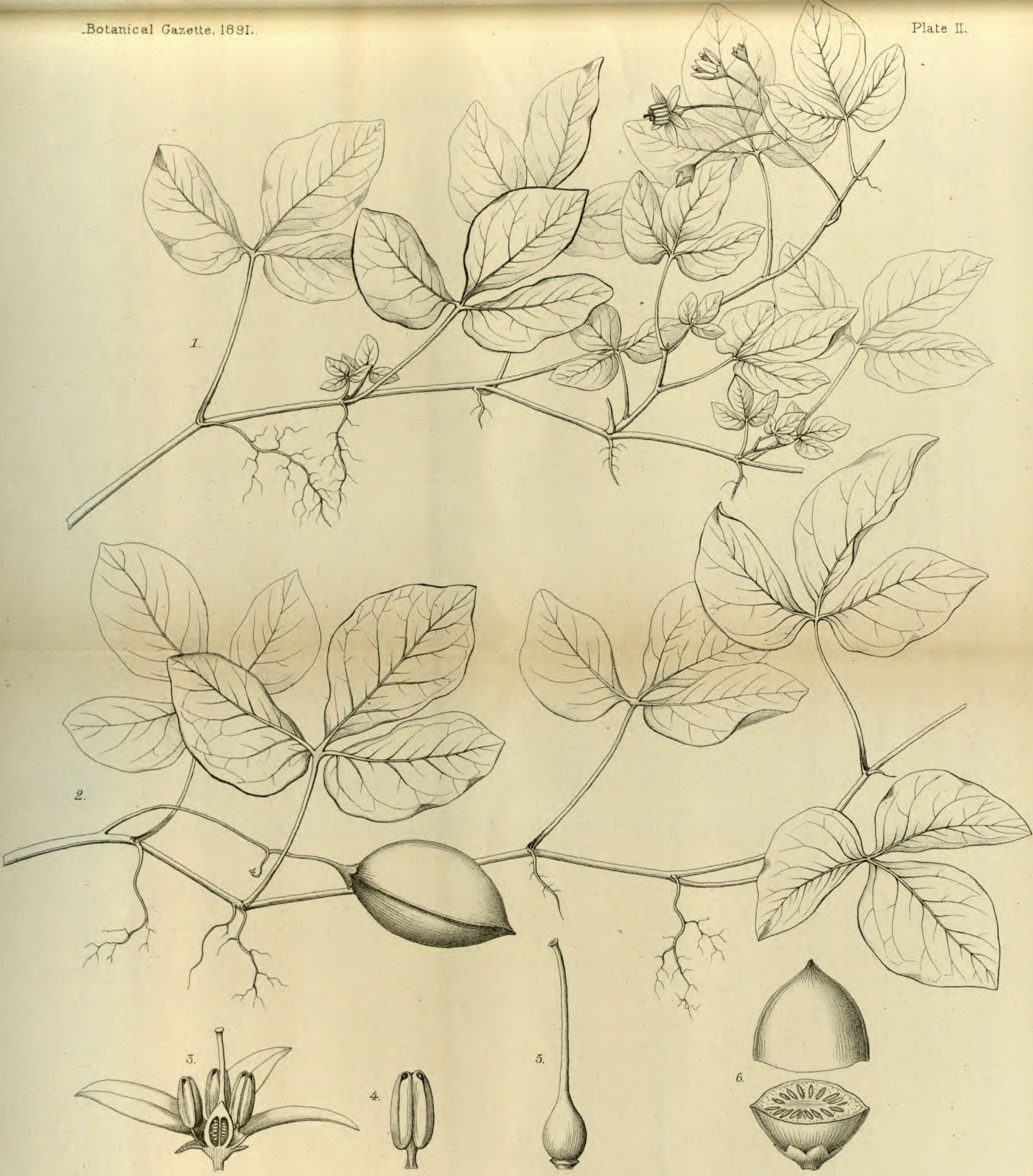
C. E. Faxon, del.

CEPHAELIS GLOMERULATA, n. sp.

B. Meisel, Lith. Boston.

Botanical Gazette, 1891. Plate II.



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SOLANUM OLIVÆFORME, J. Donnell Smith.

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THAXTER on HYPHOMYCETES.

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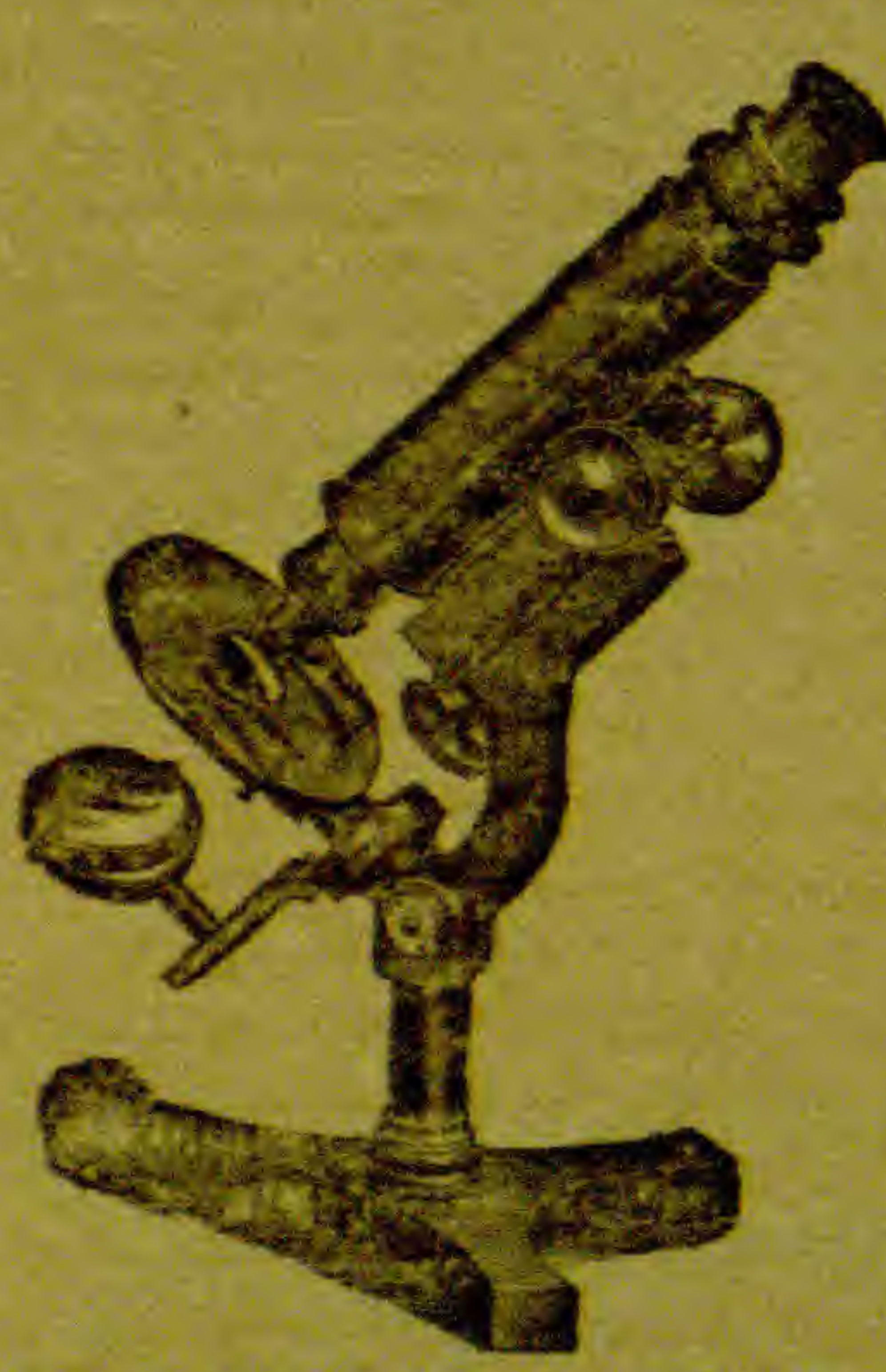

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VOL. XVI. NO. 2.—BOTANICAL GAZETTE.—FEB., 1891.

Notes on the apical growth in the roots of Osmunda and Botrychium.

DOUGLAS HOUGHTON CAMPBELL.

(WITH PLATE V.)

With the rapid advance in histological methods, it has now become possible to study with the utmost exactness the development of the most delicate plant tissues, and in consequence a new impulse has been given to the investigation of the histogeny of the higher plants, with a view to elucidating their affinities.

Naturally the Pteridophytes have been among the most frequently investigated forms, and my purpose here is to put in brief form the results of some observations on the growing points of the roots of Osmunda and Botrychium, which may serve to supplement the more extended researches of other authors on the ferns.

Of the genus Osmunda, O. regalis has been exhaustively studied by Bower[1], but our other native species, O. cinnamomea, and especially O. Claytoniana are, so far as their histology is concerned, almost unknown.

These species, therefore, were chosen for the examination of the roots. Of the genus Botrychium, B. ternatum, and B. Virginianum were used.

The roots were fixed with a 1 per cent aqueous solution of chromic acid, or in some cases with Flemming's chrom-osmic-acetic-acid mixture, but the former was found to give the best results. After thoroughly washing, to remove all traces of the acid, and then dehydrating, the specimens were brought gradually through turpentine and then imbedded in paraffin and sectioned on a Minot microtome. Various stains were tried, but by far the most satisfactory was a solution of Bismarck-brown in 70 per cent. alcohol. The specimens were stained on the slide with this mixture, which stains the young cell-walls strongly, and renders the study of the earlier cell-divisions an easy matter.

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[1] Bower: The comparative examination of the meristems of ferns as a phylogenetic study. *Annals of Botany*, vol. iii, no. 9, Aug. 1889.

OSMUNDACEÆ.—The Osmundaceæ differ in several respects from the true leptosporangiate ferns, seeming to connect the latter, to a certain extent, with the Marattiaceæ, and perhaps with the Ophioglosseæ. An examination of sections of the root-tips shows that the almost mathematical regularity that prevails in the segmentation of the apical cell of the Leptosporangiatæ and Equisetum is here very much less evident. Bower[1] states that in O. regalis there may be a single apical cell of the same form as in the leptosporangiate ferns, but that it never shows the same regularity in its segmentation, and that it may be replaced by two or three initial cells, or a single four-sided pyramidal initial. In Todea barbara[2] (also one of the Osmundaceæ) he found usually four similar initial cells, and in no case a single one, although Van Tieghem and Douliot[3] ascribe to this species a single apical cell of the ordinary fern-type.

Of the two species investigated by me, O. cinnamomea approached, on the whole, more nearly the forms described and figured by Bower; O. Claytoniana resembled more the ordinary fern-type in the regularity of the segmentation of the apical cell, although this seems to be regularly a four-sided pyramid, instead of three-sided as in the other true ferns.

Osmunda cinnamomea.—This species seems to correspond in many respects with O. regalis. The roots are stout, and sections, either transverse or longitudinal, show the cells at the growing-point to be very large, with correspondingly large nuclei, but relatively little protoplasm. In all specimens examined, there appeared to be a single initial cell, but owing to the large size of the young segments, it was not always easy to determine positively that this was the case; but a careful examination of the sections led to the conclusion that all the cells were traceable to a single apical cell.

The apical cell, seen in profile, is more or less regularly triangular (fig. 1), but may be truncate at the base. In all the transverse sections examined, this cell appeared nearly square, so that the normal form of the apical cell in this species appears to be a four-sided pyramid. In transverse sec-

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[1] L. c., p. 310.

[2] L. c., p. 314.

[3] Van Tieghem et Douliot: L'Origine des Radicelles, *Ann. des. Sci. Nat.* (Bot.) 1888, vol. viii, pp. 378–380. These authors state that all the Osmundaceæ examined by them have a single apical cell, essentially like that of the other ferns, but their accounts are very brief.

tions (figs. 2, 3), the adjacent cells are sometimes of nearly the same size and shape as the apical cell; but this position generally shows plainly that they are derived from it, and the relation of the young segments to the apical cell may be readily made out (fig. 2). It is, of course, not impossible that here, as in Todea, there may be sometimes four initial cells, but this view is not supported by my own observations.

Owing to the slowness of cell-division in the young segments, and the comparative irregularity of the same, it is difficult to trace the limits of the segments beyond the youngest ones.

The apical cell, as in O. regalis, is deeper than in most Filicineæ, but from its faces the segments are cut off much as in the latter. The segments usually form a spiral, although cases were met with that looked as if this were not the case, but that they arose in pairs from opposite sides of the four-sided initial-cell. From the outer face segments are also cut off, and these contribute to the growth of the root-cap, but this is also formed in part from cells cut off from the young lateral segments (fig. 1).

While the earlier divisions of the young segments do not follow any absolute rule, nevertheless they correspond in the main to those observed in the other Filices. The first wall in the young segment usually divides it radially into two cells, one of which is deeper than the other, as the wall does not exactly bisect the segment. This is followed in each semi-segment by a transverse wall that separates an inner small cell from an outer larger one. The former, as in the other ferns, probably gives rise only to the plerome-cylinder; the latter to periblem and dermatogen, and in part also to the root-cap (fig. 1). As the root-cap is derived both from the outer segments of the apical cell and the outer cells of the lateral segments, its inner layers lack that regularity that is so marked in most ferns; but as the cells enlarge this irregularity is in great part lost, and the outer layers of cells show a stratified appearance, nearly as regular as in the other Filices.

The plerome cylinder is in this species especially large, somewhat oval in section, but with poorly defined limits, so that it is not possible to state positively whether or not it owes its origin exclusively to the innermost cells of the segments. Occupying the center are several very wide cells that early cease to divide and are very conspicuous. These are the young tracheæ, and in this species are especially noticeable (fig. 1, *tr*).

Osmunda Claytoniana.— On comparing the roots of this species with the foregoing, we are struck first by their smaller size; and on examining the growing-point, the cells show a corresponding decrease in size, as well as greater regularity in the divisions of the apical cell and its segments. As in O. cinnamomea, the apical cell appears in vertical section deeply triangular, or occasionally truncate below. In one case (fig. 5), which closely resembles Bower's figures, 10 and 14[1], two cells of very similar appearance occupied the growing point, but the smaller of these two, *x'*, was probably a segment of the larger one, *x*, which is to be regarded as the real apical cell. In transverse sections, a single, four-sided cell was met with in nearly every case, and from its position, and that of the surrounding cells, was unmistakably the single initial cell. It is usually quite regularly oblong, and the divisions of the segments show a very considerable degree of regularity. In no case was a regular three-sided apical cell met with, although in one section (fig. 7) it was nearly of this form; but an examination of the adjacent segments showed that this was in all probability only temporary, as the youngest set of segments formed a nearly perfect rectangle, and the three-sided form of the apical cell apparently arose from the walls cutting off segments on opposite sides of the cell deviating so far from their normally parallel direction as to intersect.

Sometimes the arrangement of the cells seen in longitudinal section is almost as regular as in the Polypodiaceæ or Equisetum (fig. 4), and in such cases the limits of the segments are traceable for a long time; and in transverse sections this is also evident for the first complete set of segments (fig. 6). From a study of both, the successive divisions in the young segments may be plainly determined. While not as diagramatically regular as in the true leptosporangiate ferns, nevertheless the divisions are much more definite than in either O. regalis or O. cinnamomea, and except for the irregularity in the formation of the root-cap, correspond very closely to the regular fern-type. The primary tissue-systems are better differentiated, and the plerome-cylinder may be traced back with certainty, at least in such regular forms as

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[1] L. c., pl. xx.

that shown in fig. 4, to the inner of the two primary cells into which each semi-segment is divided.[1] (fig. 4, *p. c.*). The plerome-cylinder is much smaller than in O. cinnamomea, and in its mature condition resembles very closely the bundle of the ordinary fern-root, and differs from the investigated species of Osmunda and Todea[2] in the better development of the bundle-sheath and in having the pericambium consisting of but one, or at most two layers. The arrangement of the tracheary tissue, too, is entirely similar to that of the Polypodiaceæ.

OPHIOGLOSSEÆ.—Unfortunately at the time these investigations were made, only a very small number of plants of Ophioglossum were obtainable, and the roots of these were not properly prepared for imbedding, the plants having been preserved in ordinary alcohol, so that it was impossible to get satisfactory preparations, and my observations were therefore confined to the two common Botrychia, B. ternatum and B. Virginianum.

The Ophioglosseæ have been comparatively little studied,[3] and the investigations that have been made on the roots are not satisfactory. B. ternatum was examined by me some time since,[4] and the results of the paper then published were confirmed for the most part; but somewhat less regularity in the segmentation of the apical cell was found to exist than there described, and a consequent departure from the ordinary fern-type.

Botrychium ternatum.—The apical cell of this species (fig. 9) is in form quite like that of the Polypodiaceæ, but the segments are noticeably larger and remain longer undivided, in which respect they approach the Osmundaceæ. The first division in the young segment (fig. 10) follows the regular rule, dividing it lengthwise into two cells, which are, however, more unequal than is usually the case in ferns, and the subsequent divisions are less definite, although they follow the same general rule. Here, as in the Osmundaceæ, the

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[1] Van Tieghem and Douliot call attention to the fact, confirmed by the observations recorded here, that the Osmundaceæ differ from the other ferns in having the innermost of the two primary cells of the semi-segment smaller, and giving rise directly to the procambium. (l. c. p. 379.)

[2] De Bary: Comp. Anat. (Eng. translation) p. 364.

[3] Holle: Ueber die Vegetationsorgane der Ophioglosseen; *Bot. Zeit.*, 1875.

[4] Campbell: The development of the root of Botrychium ternatum; *Bot. Gazette*, March, 1886.

plerome initial cell becomes separated before the division of the outer cells of the segment and the initials of the periblem and dermatogen.[1] The cap segments, however, show much less regularity, and the stratification of the root-cap is soon entirely lost. Comparing, too, the apex of the root (exclusive of the root-cap) with that of most other ferns, it is found to be much more convex.

Botrychium Virginianum.—Comparing the root of B. Virginianum (fig. 11) with B. ternatum, while the structure on the whole is closely similar, the former species approaches more nearly the fern-type. Sometimes (fig. 12) the cross-section shows almost as perfect regularity as in the Polypodiaceæ, and this is evident, too, though to a less degree, in longitudinal sections. The root-tip is flatter than in B. ternatum, and the stratification of the root-cap more evident, although much less so than in the Filices.

CONCLUSIONS.—As a result of the foregoing statements, it appears that in the Osmundaceæ there may be very considerable variations in the structure of the root-tip, and that of our native species, O. Claytoniana, on the whole, departs least from the ordinary fern-type, and may be looked upon as the most nearly related to the true Leptosporangiatæ.[2]

Of the two species of Botrychium, B. Virginianum approaches more nearly the Filices in the structure of its roots, as it does in other respects.[3] A further investigation of Ophioglossum and the simpler species of Botrychium will probably show in these a still further departure from the type than in B. ternatum.

Bloomington, Indiana, November, 1890.

EXPLANATION OF PLATE V.

All magnified about 175 diameters. *x*, apical cell. *a*, *a*, the primary wall in the young segment. The boundaries of the younger segments are indicated by the heavy lines.

Figs. 1-3. Osmunda cinnamomea. Fig. 1, longitudinal; 2 and 3, transverse sections. *tr*, young tracheæ.

Figs. 4-8. O. Claytoniana. 4, 5, longitudinal; 6, 7, transverse sections. Fig. 8 is a transverse section a short distance below the apical cell. In fig. 5 the youngest segment (*x'*), closely resembles in form the true initial cell (*x*).

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[1] Van Tieghem and Douliot dispute the view that the epidermis of the root in any ferns is derived from the lateral segments at all, but claim that it originates from the outer segments, the same that form the root-cap.

[2] The conclusion given here, based upon the roots, is also confirmed by a study of the prothallium, which in several respects resembles the Polypodiaceæ more closely than does either O. cinnamomea or O. regalis.

[3] Campbell: On the affinities of the Filicineæ; *Bot. Gazette*, Jan., 1890, p. 5.

Figs. 9, 10. Botrychium ternatum. 9, longitudinal; 10, transverse section.
Figs. 11, 12. Similar sections of B. Virginianum. *p. c.*, procambium cylinder.
Fig. 13. Transverse section of the root of B. ternatum just below the apical cell. The outlines of the first three segments are distinguishable.

Two new plants from the Cascade Mountains.

B. L. ROBINSON.

(WITH PLATE VI.)

In a small collection of phænogams from Mt. Rainier and vicinity, sent by Mr. C. V. Piper to the Gray Herbarium, two new species occur, which form the subject of the present paper. One of them is more or less closely related to *Luina hypoleuca* Benth. and *Cacaliopsis Nardosmia* Gray, and is of special interest, since it does not fall strictly within the limits of either genus as now described. Since, however, both of these genera are monotypic it seems highly injudicious to add a third genus to the group, intermediate between the two, and also of a single species. As will be seen from the description that follows, the new species resembles, on the whole, the older genus Luina more closely, the most important point in which it differs from it being the entire or subentire base of the anthers, in which respect it is more like Cacaliopsis. In its sessile entire leaves, few-flowered oblong heads with few rigid involucral scales, it accords with Luina. Its inflorescence is still more racemose than in Cacaliopsis, and, as in that genus, the upper bracts are adnate to the pedicels; in the entire absence of pubescence from stem and leaves, in the tawny pappus, and in some characters of the corolla it differs from both. While highly probable that Luina should be made to include Cacaliopsis, this point may well be left for future discoveries to decide. The characters of the new species are as follows:

Luina Piperi. (Pl. VI, figs. 1–6).—Stem simple, virgate, striate, glabrous: cauline leaves oblong-lanceolate, shortly acuminate, narrowed to sessile base, entire, in the single type specimen green and glabrous on both sides; radical leaves unknown: inflorescence racemose, one foot long; pedicels 2–6 lines long, together with the involucral scales somewhat tomentose: heads 5–7-flowered, the lower scattered, cernuous, and subtended by lanceolate foliaceous bracts, the upper approximate, subspicate, erect, and with filiform bracts, which are adnate to the bases of the pedicels: involucre cylindric, of 5–7 linear or narrowly oblong, rigid, more or less carinate, acute bracts: pappus a little tawny: lobes of the corolla as long as the throat.—On Mt. Rainier, at 6,500 feet altitude; collected by C. V. Piper, August, 1888.

In *L. hypoleuca* Benth. the throat of the corolla is comparatively long and the teeth short. The proper tube is also short and manifests near the middle a peculiar change of consistence, the lower part being of firmer texture and perceptibly greater diameter than the upper. In L. Piperi the proper tube is long and slender, and is of like texture throughout.

The other plant to be described is a Silene, identical with two unnamed specimens already in the Gray Herbarium from other localities. On investigation it has been found that these plants, while agreeing closely with one another, differ in several significant particulars from any member of the genus yet described, and deserve therefore a place as a new species, the characters being as follows:

Silene Suksdorfii. (Pl. VI, figs. 9–11).—A low cespitose alpine perennial: stems 2–3 inches high, usually simple, 1–3-flowered, minutely pubescent below, glandular above: cauline leaves about two pairs, 3–7 lines long, one line wide, linear, obtuse or acutish; radical leaves numerous, crowded, similar to the cauline or a little spatulate: calyx glandular-pubescent, broadly cylindric, 5 lines high by 3 lines broad, the ten nerves conspicuously anastomosing above, but unbranched below the middle of the tube: petals white, not deeply bifid, the lobes entire or minutely erose, but with no prominent lateral tooth; appendages oblong, retuse: ovary raised on a stipe, which is 1½ lines long.

This species most nearly resembles *S. Grayi* Watson (pl. VI, figs. 7–8) but is distinguished by its lower habit, more stipitate ovary, the shorter untoothed lobes of its petals, and the character of the calyx, since in S. Grayi the nerves of the calyx do not anastomose with each other, but remain quite distinct, as may be seen from fig. 7. Specimens of S. Suksdorfii have been sent to the Gray Herbarium from the following localities in the Cascade Mountains of Washington: Mt. Paddo (Adams), at 7,000–8,000 feet altitude, collected by W.

N. Suksdorf, Aug. 9th, 1882; Mt. Stewart, collected by T. S. Brandegee, Aug. 1883; Mt. Rainier at 8,000 feet altitude, collected by C. V. Piper, Aug. 1888.

Cambridge, Mass., Oct. 1890.

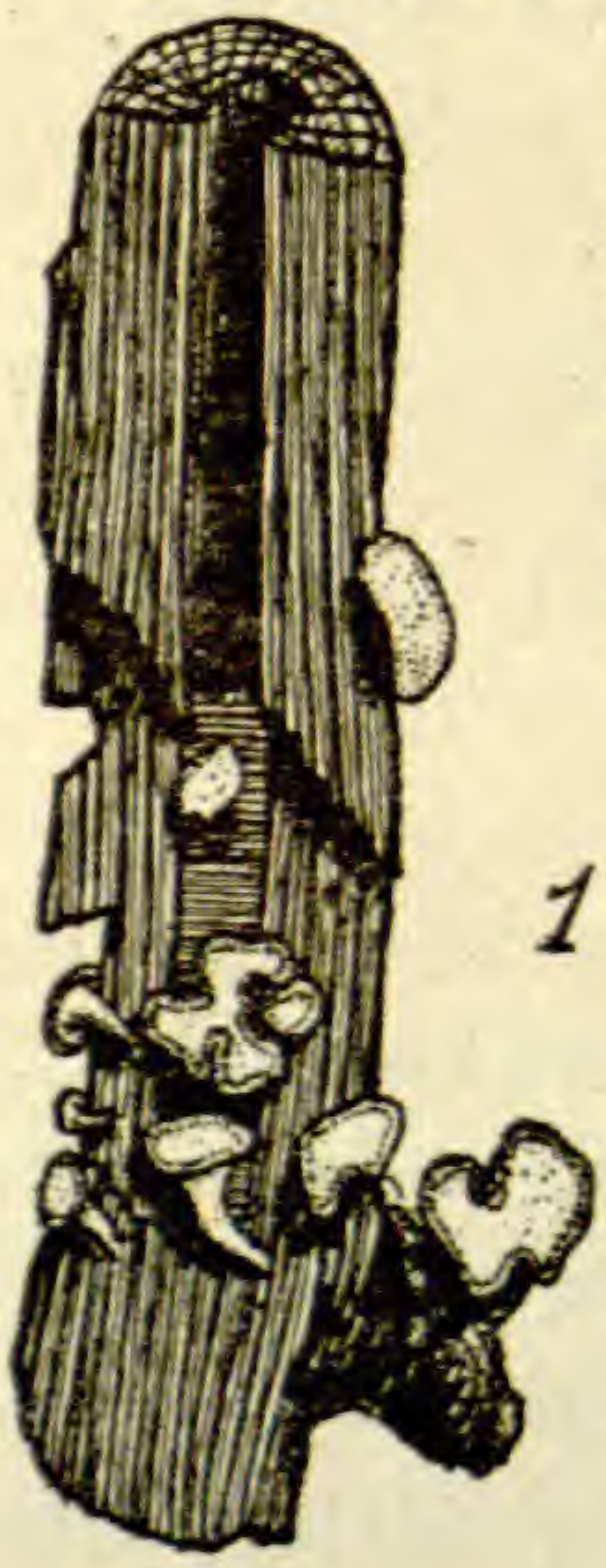
New Species of Montana Fungi.

J. B. ELLIS AND F. W. ANDERSON.

(WITH PLATE VII.)

Lentinus pholiotoides. — Cespitose, 2 cm. high, tough and elastic. Pileus convex 1.5–2 cm. diam., appressed pilose-squamose with a few appressed wart-like scales in the disk; color at first yellowish white, becoming subferruginous. Lamellæ sinuate, attached with a decurrent tooth, hardly crowded, 2–2.5 mm. wide, margins acute, minutely fimbriate-serrulate, dull white becoming yellowish, subventricose. Stem mostly curved or crooked, tough, elastic, spongy within, minutely pubescent above, loosely floccose-squamose below, a little paler than the pileus, 2 cm. high, 3 mm. thick. Spores white, oblong, obtuse with an oblique apiculus, $10–14 \times 5–6\mu$. Basidia $35–40 \times 8–10\mu$, clavate-cylindrical. Has the aspect of a Pholiota.—On dead Populus tremuloides. Sand Coulee, Montana, May, 1889.

Helotium Montaniense. — Substipitate, pale flesh color, 1–1.5 mm. across, concave with the margin repand and lobed or undulate, rather lighter outside, glabrous and subplicate, contracted into a short stipe about 1 mm. long or nearly sessile. In shape and size about like *Mollisia cinerea* Batsch, but differing in color and in being stipi-



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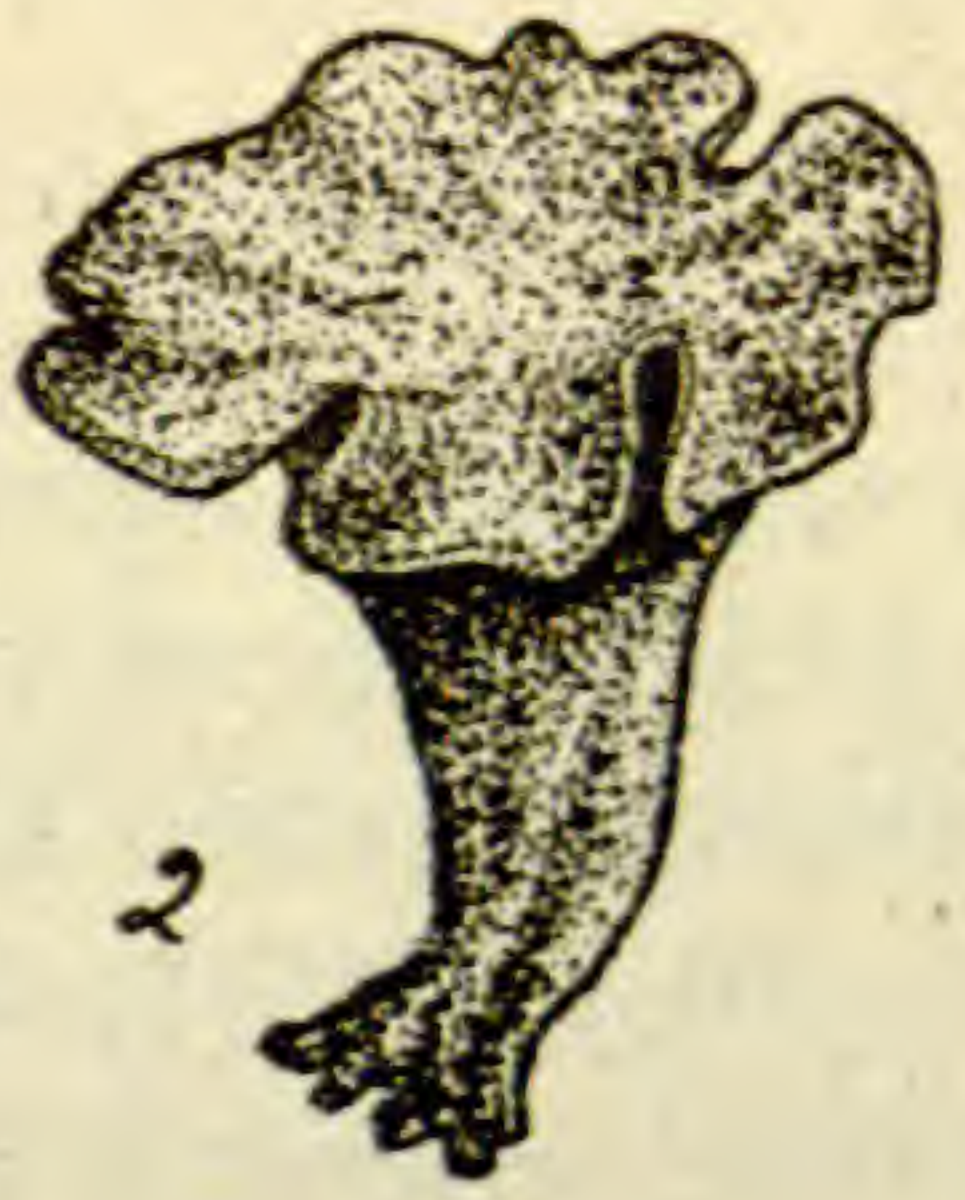

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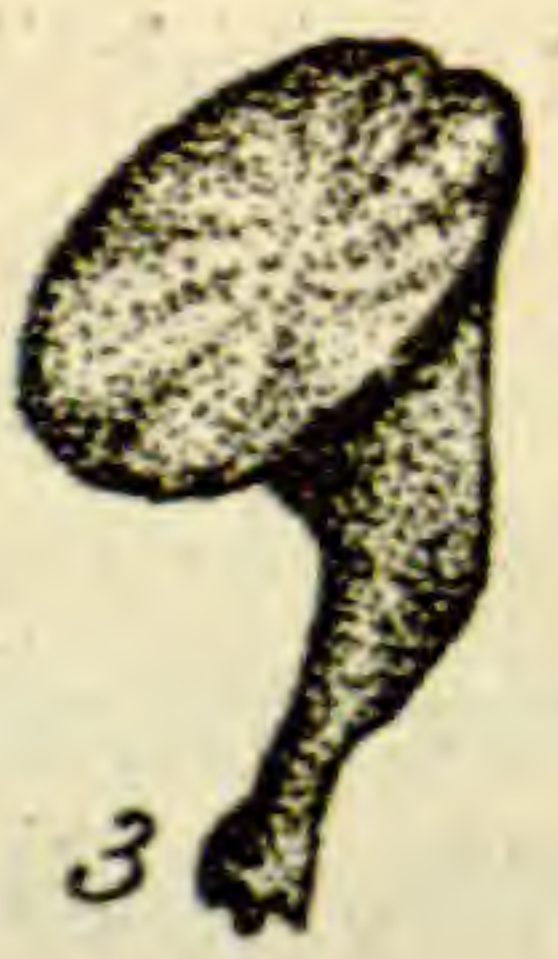

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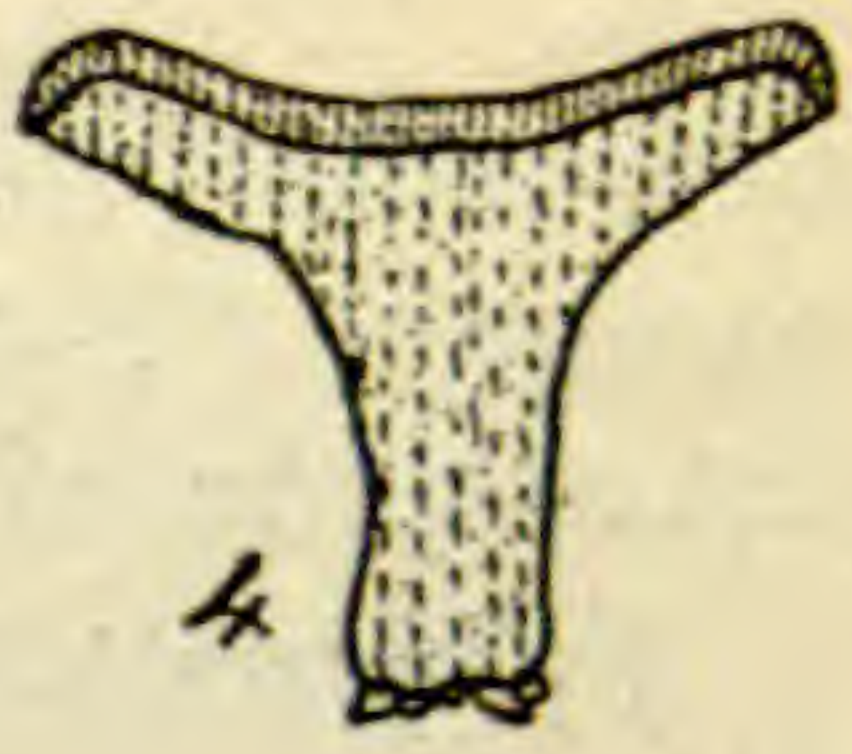

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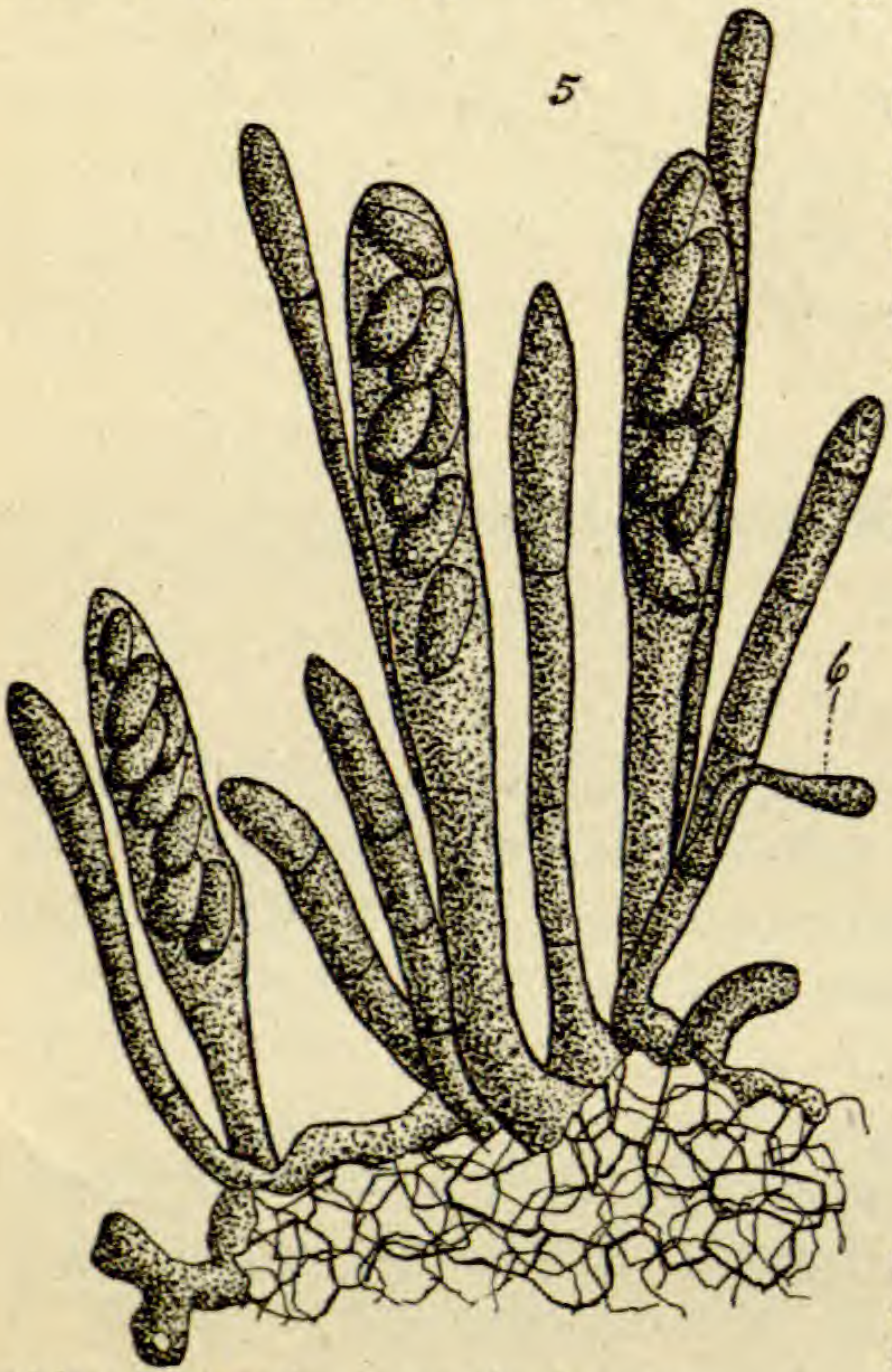
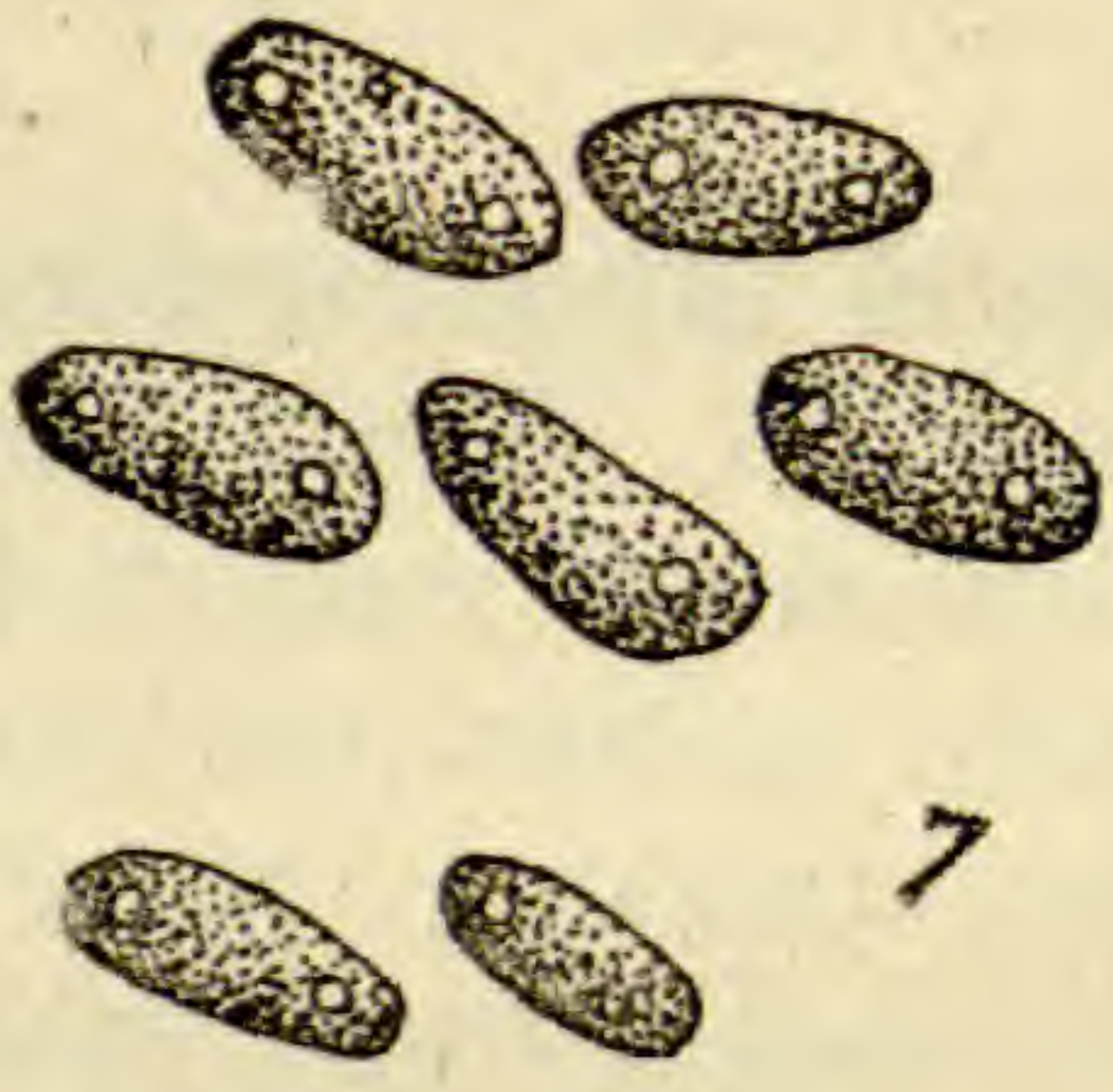
tate. Asci clavate-cylindrical, 60–65 × 6–7μ. Paraphyses filiform, gradually but slightly thickened above. Sporidia 1-seriate, elliptical or ovate-elliptical, hyaline, subinequilateral, with a small nucleus in each end, 8–10 × 3–4μ. On decaying sticks and wood in wet places. — Sand Coulee, Cascade co., Montana, May 1889.—Anderson, no. 490.





Explanation of Figures. — 1, about natural size, on dead wood; 2, a mature specimen considerably enlarged; 3, a somewhat younger specimen considerably enlarged; 4, vertical section, showing hymenial layer; 5, group of asci and paraphyses in situ; on the side (at 6) a paraphysis peculiarly branched; 7, mature spores. Figs. 5 and 7 much magnified.

Phoma ilicina.—Amphigenous. Perithecia innate, raising the cuticle into little pustules, with the apex suberumpent, globose, small (0.2mm. diam.) Sporules fusoid-oblong, hyaline, 2-nucleate, 6–8 × 2–3μ, on basidia of about the same length as the sporules themselves. — On dead holly leaves (Ilex sp.), Washington, D. C., Oct. 1890.

Coniothyrium ilicinum.— Perithecia epiphyllous, rather prominent, the epidermis blackened over them. Sporules subglobose, or short-elliptical, pale-brown, about 2.5 or 3μ in the longer diameter. — On same leaves as preceding.

Dothiorella Nelumbii.— Perithecia scattered, semi-erumpent, rough, black, pierced above, about 150μ diam., depressed-spherical or sublenticular. Sporules oblong-fusoid, hyaline, 15–22 × 6–7μ. Has the aspect of a Sphærella. — On receptacle of Nelumbium, Washington, D. C., Oct. 1890.

Volutella occidentalis. (Plate VII, figs. 1–6.) — Sporodochia gregarious, thin and flat, about 1 mm. or a little more in diameter, pale orange or flesh-color, fringed with suberect, pale, roughish, faintly septate hairs 110–150μ long. Conidia cylindrical, straight, hyaline, with a nucleus in each end, 6–8.5 × 1.5–2μ, concatenate on branched basidia and formed by the constriction of the upper part of these branches (figs. 5 and 6.)—On dead stems of Astragalus flexuosus and A. Drummondii. Sand Coulee, Cascade co., Montana, May 1889.

This is closely allied to *V. gilva* (Pers.) but differs from Saccardo's description of that species and from his figure in F. Ital. 728, in its concatenate, shorter conidia and branching basidia. The specimen of V. gilva in Sydow's Mycotheca Marchica differs from this in its much longer (500μ) brownish hairs and rather narrower (1.5μ) conidia and from the description in Sylloge Fung. in its longer hairs and shorter (6–8μ) conidia.

Var. **minor** differs in its slenderer, smoother hairs and smaller (5–6 × 1.25–1.5μ) conidia.—On dead Salix.

Sporidesmium sorisporioides.—Forming thin, tobacco-brown, narrow, elongated, sublinear strips or patches, 2–5 cm. or more long, evenly effused and composed of nearly globose cells 12–15μ diam. loosely combined into glomerules (conidia) 25–40μ diam. almost exactly like the spore masses of Sorosporium.—On decaying wood. Montana, June 1889. Anderson, no. 519.

Macrosporium puccinioides. (Plate VII, figs. 7–11.).—Tufts hysteriiform, narrow, 2–3 mm. long, erumpent through longitudinal cracks in the cortex of the stem so as to closely resemble a Puccinia. Hyphæ erect, simple, septate, yellowish-hyaline, 60–70 × 5μ, densely compacted, at first swollen at the apex, then the swollen part becomes 1-septate and assumes an elliptical or oval shape, 20–30 × 15–20μ, and finally becomes elongated, oblong or clavate-oblong, 60–70 × 18–22μ, brown, 3–4-septate and muriform. The resemblance to Puccinia is very striking.—On dead stems of Bigeloviæ? with *Dothidea Montaniensis*, E. & E. Helena, Montana, Nov. 1888. Rev. F. D. Kelsey.

Æcidium Liatridis.—Spermogonia small, epiphyllous, black, on slightly thickened, light colored, sometimes purplish-bordered, elongated spots, 0.5–1 cm. long by 3–4 mm. wide. Æcidia hypophyllous, thickly scattered on the spots, the pseudo-peridia narrow-cylindrical or slightly enlarged above, two to six times as long as broad, white or slightly pinkish, margin usually irregularly lacerated. Spores subglobose, oblong or ovate, 20–26μ in their longer diameter.—On leaves of Liatris punctata. Great Falls, Montana, July, 1888.

This appears to be the *Æ. Compositarum* Mart. var. *Liatridis* Webber, in his Cat. Fl. Nebr. 1889, p. 70; but the elongated pseudo-peridia seem to distinguish it from any of the forms of Æ. Compositarum. Webber speaks of the pseudo-peridia being very short, so that what he has described may be another thing.

Æcidium Cleomis.—Amphigenous, on brownish, slightly thickened spots. Small, about 0.33 mm. diam. closed at first, then open but scarcely recurved, margin sublacerate. Spores irregularly globose or subovate, 15–20μ diam.—On Cleome integrifolia. Helena, Montana, May, 1887. Anderson, no. 3.

Æcidium Chrysopsidis.—Spots thickened, pale, immarginate, 2.5–5 mm. diam., mostly on one side of the midrib, but sometimes extended entirely across the leaf and longitudinally for 1 cm. or more. Æcidia irregularly scattered or sometimes subconcentrically arranged so as to leave a vacant space in the center, entirely buried, showing at first only as slight mammiform projections, on the surface of the spots, finally, with a round opening above and either without any projecting margin or at most with a very slight and narrow one. Spores yellow, mostly ovate-oblong, 18–23 × 14–16μ. Peridial cells mostly ovate, coarsely cellular, 30–35 × 15–25μ.—On leaves of Chrysopsis villosa. Sand Coulee, Cascade co., Montana, June, 1888.

There is an Æcidium on Gutierrezia Euthamiæ that is very near this if not identical with it.

Pestalozziella Andersoni Ell. and Evrht. (Plate VII, figs. 12–14.).—Acervuli amphigenous, gregarious, not on definite spots, small, convex-hemispherical, black. Sporules ovate-elliptical, hyaline, continuous, with a spreading, sub-3-parted crest of hyaline bristles or threads.—On fading leaves of Apocynum or Asclepias. Sand Coulee, Montana, leg. F. W. Anderson.

Newfield, N. J. and New York City.

EXPLANATION OF PLATE VII.

Fig. 1. *Volutella occidentalis* Ell. and Anders., natural size on dead stems of Astragalus Drummondii; 2, sporodochium of same magnified; 3, vertical section

of sporodochium more highly magnified, showing mass of loose spores and scurfy matter on top, sparingly mixed with the characteristic hairs; 4, a group of basidia with the hairs highly magnified; 6, a branching basidum and loose spores very highly magnified. 7, *Macrosporium puccinioides* Ell. and Anders., on dead stems of Bigelovia (?) Montana, Kelsey, slightly magnified; 8, a group of forming and young spores rising from the interwoven threads forming the substratum of the sporodochium; 9, a cluster of mature spores; 10, two mature spores showing the stipitate base; 11, three young spores, showing the remarkable resemblance to Puccinia spores. 12, *Pestalozziella Andersoni* Ell. and Evrht., natural size on small leaf of Apocynum cannabinum; 13, vertical section through a leaf showing the destructiveness of the fungus; highly magnified; 14, five spores more highly magnified.

A key to the North American genera of the Labiatæ.

ALFRED C. STOKES.

While the keys to this group in Gray's Manual and in other botanies are praiseworthy in many respects, they are not adapted to use in the field, unless that use is to be limited to those who have become experts. To the beginner and the amateur they are disheartening. The following compilation from the Synoptical Flora is in reality Professor Gray's alone; all that I have done is to attempt to use only the more obvious characters that will lead to the genera in the most direct way. That even so limited a paper as this is free from errors is not expected. Notice of blunders will be gladly received from those that may try to use the key.

I. Ovary merely 4-lobed, not deeply 4-parted (A).

II. Ovary deeply 4-parted (B).

III. Ovary deeply 5-lobed; corolla almost regular, 5-parted, blue ....**Isanthus**, 3.

A Stamens exserted from the cleft in the upper lip of the corolla (b).

A Stamens not exserted from the cleft in the upper lip of the obscurely bilabiate corolla (a).

a Calyx deeply 5-cleft, regular, lobes lanceolate, twice as long as the turbinate tube; corolla nearly salverform.....**Tetraclea**, 1.

a Calyx barely 5-cleft; corolla tube narrow; filaments long exserted.....**Trichostema**, 2.

b Corolla upper lip deeply cleft, the lower declined, lateral lobes united to it....**Teucrium**, 4.

b Corolla upper lip short, truncate; lower lip large, middle lobe emarginate or 2-cleft....**Ajuga**, 5.

B Stamens declined toward or resting on the lower lip (C).

B Stamens not declined (D).

C Disk enlarged into glands; posterior calyx teeth broad, with decurrent often wing-like margins....**Ocimum**, 6.

C Disk entire or with an anterior gland; calyx not as above....**Hyptis**, 7.

D Corolla upper lip not galeate, sometimes slightly concave (E).

D Corolla upper lip galeate or concave (1).

E Corolla not strongly bilabiate (F).

E Corolla bilabiate; fertile stamens 2 only (V).

E Corolla bilabiate; fertile stamens 4 (Y).

F Corolla lower lobe large, pendent, fimbriate; stamens straight, long, divergent....**Collinsonia**, 8.

F Corolla lower lobe spreading, 3-cleft, no bearded ring within (H).

F Corolla about equally 4-lobed, hardly irregular; stamens erect (G).

F Corolla tube broad, lobes 5, broad, plane, rather erect; stamens 4, distant....**Sphacele**, 27.

G Fertile stamens 4....**Mentha**, 9.

G Fertile stamens 2; upper corolla lobe entire....**Lycopus**, 10.

H Stamens distant, straight, never convergent nor curved (I).

H Stamens ascending or arcuate, often converging or parallel (M).

I Fertile stamens 2 only; calyx equally 5-toothed, throat very villous....**Cunila**, 11.

I Fertile stamens 4; calyx throat naked (J).

I Fertile stamens 4; calyx throat bearded (L).

J Corolla upper lip entire or slightly emarginate (K).

J Corolla upper lip 2-cleft, all the lobes narrow, plane....**Monardella**, 14.

K Anther cells linear, divaricate....**Hyssopus**, 12.

K Anther cells parallel....**Pycnanthemum**, 13.

L Flowers imbricated with broad, colored bracts....**Origanum**, 15.

L Flowers scattered or crowded, bracts inconspicuous....**Thymus**, 16.

M Calyx campanulate or short; corolla tube short, or not exceeding the bracts; fertile stamens 4; calyx about 10-nerved, throat naked....**Satureia**, 17.

M Calyx various, 12 to 15-nerved (N).

N Upper corolla lip plane or slightly concave and straight (O).

N Upper corolla lip concave, erect, straight or a little incurved; calyx 15-nerved (U).

O Style beardless (P).

O Style villous, sometimes sparingly so; stamens sometimes 2 only (T).

P Stamens 4 (Q).

P Stamens 2 (S).

Q Stamens arcuate, shorter than the corolla; calyx about equally 5-toothed.... **Micromeria, 18.**

Q Stamens ascending under the upper lip (R).

R Corolla tube straight, mostly exceeding the calyx; throat commonly enlarged.... **Calamintha, 19.**

R Corolla tube straight, bent backward at the throat, ringent, shorter than the calyx; leaves linear, margins revolute.... **Conradina, 21.**

R Corolla tube declined at base, then ascending, included in the calyx; leaves ovate, serrate.... **Melissa, 20.**

S Fruticulose and canescent; calyx terete and regular; equally 5-toothed or nearly so; corolla mostly with a hairy ring within.... **Poliomintha, 22.**

S Low herbs; calyx usually gibbous, more or less bilabiate or unequally 5-toothed; corolla tube naked.... **Hedeoma, 23.**

T Calyx deeply and unequally 5-cleft, campanulate or turbinate, ciliate, throat naked.... **Pogogyne, 24.**

T Calyx bilabiate, nearly terete, throat villous; leaves linear, entire .... **Ceranthera, 25.**

U Calyx bilabiate, throat naked, teeth acerose-spinulose; stamens inserted high in the ampliate throat, anther cells 2, divaricate.... **Acanthomintha, 26.**

V Calyx bilabiate, lower lip 2-cleft (W).

V Calyx tubular or bilabiate with lower lip 2-toothed (X).

W Corolla upper lip erect, usually concave; stamens on the throat; connective linear or filiform, transverse on the short mostly horizontal filament.... **Salvia, 28.**

W Corolla upper lip spreading; filaments exserted, seemingly simple, anthers linear, 1-celled; calyx deeply cleft as if spathaceous, throat naked.... **Aubertia, 29.**

X Calyx nearly regular, 5-toothed, orifice more or less hirsute.... **Monarda, 30.**

X Calyx bilabiate, throat naked, teeth subulate.... **Blephilia, 31.**

Y Anthers not approximate in pairs, the cells parallel (Z).

Y Anthers more or less approximate in pairs, the cells divergent; filaments not exserted (ZZ).

Z Stamens divergent or distant, exserted.... **Lophanthus, 32.**

Z Stamens parallel, ascending.... **Cedronella, 33.**

ZZ Calyx about equally 5-toothed, throat more or less oblique.... **Nepeta, 34.**

ZZ Calyx upper tooth much larger than the others, throat equal .... **Dracocephalus, 35.**

1 Calyx with a dorsal crest-like projection.... **Scutellaria**, 36.

1 Calyx without a dorsal projection (2)

2 Calyx globular or oblong, barely repand-bilabiate.... **Salizaria**, 37.

2 Calyx deeply bilabiate (3)

2 Calyx not bilabiate, 3 to 5–lobed (4).

2 Calyx not bilabiate, 5 to 10–toothed (5)

3 Filaments of the upper pair 2–toothed at apex, one tooth naked, the other bearing the divaricate-celled anther.... **Brunella**, 38.

3 Filaments simple.... **Brazoria**, 39.

4 Calyx sub-regular, equally 5–toothed; flowers simply opposite in the spikes, one under each bract.... **Physostegia**, 40.

4 Calyx tubular-campanulate, 3–lobed; inflorescence terminal and capitate, 2 or 3 flowers under each bract.... **Macbridea**, 41.

4 Calyx campanulate, inflated, deeply 4–cleft; inflorescence simply and loosely leafy-spicate.... **Synandra**, 42.

5 Stamens included in the short tube, upper lip merely concave; calyx strongly ribbed, teeth 5 to 10, subulate or spinulose; leaves rugose.... **Marrubium**, 43.

5 Stamens ascending beneath the galeate upper lip (6).

6 Stamens not deflexed after anthesis (7).

6 Stamens deflexed to the sides of the throat or contorted after anthesis (10).

7 Calyx turbinate or tubular–campanulate, commonly oblique, filaments not appendaged (9).

7 Calyx tubular (8).

7 Calyx funnelform-dilated at the throat; filaments not appendaged.... **Ballota**, 44.

8 Corolla upper lip strongly galeate; upper pair of stamens appendaged at base.... **Phlomis**, 45.

8 Corolla upper lip erect, or incurved and elongate entire; filaments not appendaged.... **Leonotis**, 46.

9 Leaves cleft or incised, veiny, all longer than the capitate-verticillastrate flowers.... **Leonurus**, 47.

9 Leaves mostly cordate.... **Lamium**, 48.

9 Leaves ovate or oblong–lanceolate; inner valve of each anther–cell hirsute, the other larger, naked.... **Galeopsis**, 49.

10 Calyx tubular-campanulate; corolla tube cylindrical, throat not dilated, upper lip erect.... **Stachys**, 50.

Trenton, N. J.

BRIEFER ARTICLES.

Observations on the new Texas fern *Notholæna Nealleyi* Seaton, as described in "Contributions from the U. S. Herbarium," ii, p. 61, no. 894, June, 1890, and a Mexican fern collected by C. G. Pringle near Gaudalajara in 1888.

The general characters are here shown in parallel columns:

Notholæna Nealleyi Seaton. Type specimens in Nat. Herb.	*Notholæna* sp.? Pringle's no. 1864, in Herb. G. E. D.
Plant 6 to 6½ inches tall. Rootstock cespitose (characterized in original description, l. c., as a slender rhizome), crowns thickly clothed with black subulate scales, slightly pectinate; fronds clustered, stipites 1 to 1½ inches long, terete, or nearly so, *black*, clothed at the base with small reddish-brown scales, above with reddish bristly minute scales and hairs extending upward and along the rachises; laminæ 4 to 5 inches long, 1½ to 2 inches broad, pinnate, oblong-lanceolate, narrowed both ways, upper surface sparingly sprinkled, lower, as well as the rachises and stipites, thickly coated with more or less deciduous *yellowish-white* ceraceous powder. *Sori brown*, continuous round the slightly recurved unchanged margins.	Plant 5 to 14 inches tall. Rootstock cespitose, crowns clothed with black subulate slightly pectinate scales; fronds clustered, stipites 2 to 3 inches long, terete, *brown*, clothed at the base with small reddish-brown scales, above with reddish bristly minute scales and hairs extending upward and along the rachises; laminæ 3 to 11 inches long, 1 to 2¼ inches broad, bi- to tripinnate, oblong-lanceolate, narrowed both ways, upper surface copiously sprinkled, lower, as well as the rachises and stipites thickly coated with *white* ceraceous powder, more or less deciduous; *sori black*, continuous round the slightly recurved unchanged margins.

Special characters noted on comparing two fronds of corresponding size and appearance in age and natural development.

N. Nealleyi Seaton. Frond pinnate, pinnæ sessile, or lowermost sub-sessile, bipinnatifid, or partially pinnated at the base, pinnules deeply lobed, ultimate lobes the largest; texture subcoriaceous, veins visible on looking through toward the light. Stipes and main rachis *black*, secondary rachises blackish beneath, green above and channelled, wing-margined, wings connecting the pinnules; lowermost pinnæ gone but probably somewhat shorter than those above.	*Notholæna* sp.? Pringle's No. 1864. Frond distinctly bipinnate nearly to the top, uppermost pinnæ sub-sessile, lowermost short stalked, pinnules distinct, sessile, deeply lobed and nearly pinnate at the base, ultimate segments the smallest, texture coriaceous, veins obscure. Stipes and main rachis *brownish*, not wing-margined nor channelled above, lowermost pinnæ shorter than those above.

In summing up conclusions from the foregoing observations it appears to be extremely unsafe to separate the two ferns into distinct species with the present material in hand. The particular differences noted seem to be only of varietal significance and do not seem to warrant disposing of the Mexican fern in any other way than by referring it to the Texan fern as a variety. I therefore name it var. **Mexicana** and have ticketed Mr. Pringle's fern as *Notholæna Nealleyi* Seaton, var. **Mexicana.**

My thanks are due to Dr. Geo. Vasey and Mr. J. N. Rose, of the National Herbarium, for their kindness and courtesy in sending to me for examination the typical specimens of Notholæna Nealleyi.—GEO. E. DAVENPORT, *Medford, Mass.*, December, 1890.

Sarcodes sanguinea.—That this plant is not a root-parasite but a saprophyte, was demonstrated by myself, Dr. Chas. Schäffer, and Col. Hutchings of Yosemite, in 1883, an account of which was the subject of one of my "Contributions." With pick and shovel we carefully surrounded and undermined some plants, and then removed the earth particle by particle from the ball; there was no attachment to host roots, nor were there any roots of any kind in the mass of earth to which they could have been attached. Fearing that the dryish earth might break off some thready matters without our perceiving them, we soaked some of these balls in a pool of water allowing the earth to gradually float away as muddy water, with the same result. But, and this is the point I want to make now, neither was there any decaying vegetable matter such as we usually find around the roots of ordinary saprophytes. After satisfying ourselves that the plant was not a parasite, and that it must be a saprophyte, one was selected in what one might call almost pure sand, but no trace of vegetable matter was apparent to the unaided vision. The plant seems scarcely symbiotic in the proper sense of the term. My own conclusions were that in some unexplained way, the plant was able to draw nitrogenous and other material from the earth without the aid of organs necessary to this end in most cases. What Dr. Oliver calls roots we did not find,—nothing but a spongy looking or coral-like mass of cellular tissue.

Since the pretty speculation regarding the nitrogenic agency of fungi in preparing food for saprophytic plants has been developed, we can detect some of this character by olfactory evidence, which I have found very satisfactory in most cases. This speculation had not been laid before us in 1883, or it would have been tested then,—but the odor of fungi, if any there were, must have been very slight or it would have been noted.—THOMAS MEEHAN, *Philadelphia.*

EDITORIAL.

Most college teachers of botany who are fit for their places would, we doubt not, greatly prefer to have pupils come to them without previous instruction (?) in botany than with the usual sort, which needs first of all eradication. For many of these false ideas the text books are responsible; for many the teachers. Misleading analogies are often suggested in text books, in books for popular reading, in lectures, and now they are appearing in alarming numbers in the bulletins of the agricultural experiment stations. The laudable object is always to make the statements more intelligible; in which object they often fail, and succeed only in implanting faulty conceptions. Two of these misleading analogies will serve as illustrations. No phrase is more common than "stomata, or *breathing*-pores," and it inevitably connects these apertures with respiration, with which they have almost, or quite, nothing to do. As well call the perspiratory ducts of the human skin "breathing-tubes"! The former analogy is as thoroughly false as the latter. Why not say air-pores if we must have an English form? Respiration is already weighted to the last limit with misunderstandings; this millstone ought to be removed from its neck. "Spores *i. e.*, bodies that are like seeds in use" — does that analogy illuminate or obscure? The writer from whom this is taken was speaking of conidia, which are much more "like" cuttings or slips in use than like seeds. But why compare at all seeds and spores, mycelium and roots, conidiophores and peduncles? Why not let it be understood from the outset that the fungi are not comparable with the phanerogams? Their structure is simple enough to be understood if described without comparison. When analogy in function is predicated, inferences of similarity in structure, wrong as they may be, are made unconsciously when one object is well known and the other wholly unknown. Examples might be multiplied. Let the teacher in the class-room, before an audience, and in popular bulletins scrupulously avoid misleading analogies.

CURRENT LITERATURE.

Adaptations to Pollination.[1]

This is a continuation of a work published in 1888 as Heft No. 10 of the Bibliotheca Botanica, and noticed in the *Gazette*, xiii, 134. The observations recorded in this volume were made in middle Germany and in the lower and higher regions of the Tyrol, in the years 1886-1888. 171 pages are devoted to a consideration of the adaptations of different flowers, which are taken up in their natural order, there being 187 species belonging to thirty-eight families. After many of the larger families there are summaries of the results. Pages 172-224 are devoted to several topics which the author has reserved for special consideration. Thus on pages 203-224 the author gives a list of perforated flowers which he found in two years, 1887-'8, stating the position of the perforations and the insects which make them. The list contains about 160 flowers, 125 of them being perforated by a single species of bumble-bee, Bombus terrestris.—R.

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[1] August Schulz.—Beitræge zur Kenntniss der Bestæubungseinrichtungen und Geschlechtsvertheilung bei den Pflanzen, Vol. II. Bibliotheca Botanica, Heft no. 17, I & II. Cassel: Theodor Fischer, 1890.

The Missouri Botanic Garden.

A hand-book of the Missouri Botanical Garden has just been issued, which in a very handsome and elaborate way gives the objects of the Garden and School of Botany, and the principal steps which have thus far been taken to forward them. The book contains 165 pages and is issued under the editorial supervision of Dr. Trelease. There are numerous handsome illustrations and a large scale map of the Garden. In addition to the presentation of the facts of organization and plans of work the book contains Mr. Thomas Dimmock's biographical sketch of Mr. Henry Shaw; Mr. Shaw's will; Dr. Trelease's inaugural address; the first annual "flower sermon" by the Rt. Rev. Daniel S. Tuttle, Bishop of Missouri; and the speeches at the first annual banquet.

Minor Notices.

THAT IMPORTANT WORK, *Die Natürlichen Pflanzenfamilien*, has now reached lieferung 54, which contains a continuation of Compositæ by Hoffman. The genera are brought up to Achillea, which is no. 545. The North American genera are very much as Dr. Gray left them, and American work in general has been adopted. This may be explained in some cases by lack of material for verification.

PART II of the Proceedings of Philadelphia Academy of Science for 1890 has been distributed and contains the following botanical titles: Descriptions of three new species of Myxomycetes, with notes on other forms in Century XXV of the N. A. F., by *Geo. A. Rex;* New N. Am. Fungi, by *J. B. Ellis and B. M. Everhart;* and Contributions to the life-histories of plants, No. 5, by *Thos. Meehan.* The contents of Mr. Meehan's contribution have been noted in this journal (xv. 345).

MESSRS. LAZENBY AND WERNER, of the Ohio State University, have published a supplementary list to the Beardslee catalogue of Ohio plants. This supplement is put out to give information as to the plants that have been discovered in Ohio since 1874, and also to call forth additional information preparatory to the publication of a complete revised catalogue. The supplement adds 177 species of Phanerogams.

Those who are interested in the relation of flowers and insects will welcome the list of books, memoirs, etc., on the fertilization of flowers for the period 1883–9, a continuation of the list published in 1883 by D'Arcy Thompson.[1] Such bibliographies are of great value and Mr. J. MacLeod has placed the workers in this field under obligations.

OPEN LETTERS.

Mounting plants.

The recent excellent note of Theo. Holm on this subject prompts me to say a few words, more especially in regard to mounting grasses. In the collection at our college the plants are held to the sheets by means of stout strips of gummed paper, often a quarter of an inch wide, or even more for securing heavy specimens. It has recently been my privilege to turn over nearly all the grasses in the herbarium of Harvard University, where they are secured to the sheets by means of glue. If well done, and the plants are not too thick and heavy, and not sent to and fro by mail or express, the glue holds the smaller, thinner specimens very well, but those with heavy culms or rootstocks spring loose in many cases, and then are usually to be "patched up" by pasting on gummed strips. The glue process would tend to prevent theft of small fragments or spikelets of valuable specimens, but it also makes it difficult to turn over or partially over a spikelet or leaf blade or sheath to observe a ligule or other part not mounted right-side out. Quite frequently specimens mounted in this way are considerably disfigured by surplus glue, and patches of the coarse paper upon which the specimen was placed while the glue was applied are left sticking here and there, like morbid tufts of a peculiar pubescence. For working specimens of grasses and sedges and similar plants, my experience leads me to favor decidedly the method of pasting by means of strips of paper. Happily, there is a rapidly growing tendency among botanists of our country to collect, preserve, and mount specimens which are more complete than those usually put up by the older botanists of a generation or two ago. Such collectors as Pringle, whose specimens have found their way into the herbaria of many botanists, have served to stimulate better work. There is another thing which does not yet receive the attention it deserves, viz.: the collecting and preservation of surplus flowers, fruits, seeds, spikelets, etc., loosely placed on most sheets and held by an envelope or folder. This whole subject with an abundance of illustrations would be an admirable one for some thorough and neat enthusiast to present to the botanical club of A. A. A. S. or even to the section of biology.—W. J. Beal, *Agricultural College, Mich.*

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[1] Separately printed from the Botanisch Jaarboek, tweede Jaargang (1890) pp. 195–254.

NOTES AND NEWS.

PROF. DR. W. P. WILSON has recently been elected a member of the German Botanical Society.

R. V. WETTSTEIN shows by the intermediate stages that each of the staminodes of Parnassia palustris represents a single stamen.

THOUVENIN after an exhaustive study of the Saxifragaceæ says that there is not a single anatomical character which is constant.

PROF. DR. H. MUELLER-THURGAU of Geisenheim has been appointed director of the German-Swiss experiment station and school for fruit, wine, and garden culture at Wädensweil near Zürich.

AN OLD LETTER of Persoon's is published in the *Am. Naturalist* (Dec.) It was found in a copy of Persoon's "Synopsis Methodica Fungorum," recently purchased for the University of Nebraska.

PROF. FRANK finds Robinia Pseudacacia capable of utilizing free nitrogen, like the other Leguminosæ. In the roots of four plants 125 days old were 0.092 gm. of N, as against 0.0024 gm. in the seed sowed.

PROF. DR. JULIUS WORTMANN of Strassburg assumed the directorship of the plant physiological station at Geisenheim on February 1. The station is a department of the royal institute of fruit and wine culture.

A NEW GENUS of Uredineæ, Barclayella, is described by Dr. Dietel in a late number of *Hedwigia* (xxix, p. 266). It is related to Chrysomyxa and Coleosporium. Only teleutospores are known. The single species described occurs in the western Himalayas, parasitic upon spruce.

HUGO DE VRIES has succeeded in obtaining for several successive years an increasing number of sterile plants of maize by sowing grain from the most poorly productive plants. He concludes, therefore, that sterility in the case under consideration is a hereditary quality susceptible of fixation.

THE *Journal of Botany* quotes some botany that has found its way into fiction (The Village Blacksmith). It is good enough to bear repetition. "The garden had been neglected . . . his roses had reverted to type, and bore suckers of bramble and large-eyed roses." This reversion to type took place in a couple of months or so.

MR. C. G. PRINGLE'S last season's collection is being determined at Cambridge, preparatory to the distribution of sets. The work was pushed farther south than ever before, and, as a consequence, the collection contains an unusual number of novelties. As soon as the sets of 1890 are distributed Mr. Pringle intends to return to Mexico.

THE EDITORS and publishers of the *Botanisches Centralblatt* announce the commencement of a series of supplements to the journal in order to allow earlier and fuller abstracts of new works. These supplements will each contain 80 pp. and seven will appear annually, increasing the size about one-third. The additional cost to subscribers to the journal will be only *M.* 10.50.

THE MOSSES collected by Dr. Julius Röll along the N. P. R. R. in 1888 were distributed to different bryologists for study, Brotherus, Müller, Venturi, Cardot, Renauld, and Barnes. From their reports diagnoses of 24 new species and 20 new subspecies and varieties are published in the *Bot. Centralblatt*, xliv, 385–391 and 417–424. The full reports are to be published later.

THE *Gardeners' Chronicle* has just celebrated its jubilee, its first number having appeared January 12, 1841. The founders were Dr. Lindley and Sir Joseph Paxton. It is to be congratulated upon its long and eminent list of contributors and upon its constantly increasing usefulness. It is one of those gardening journals that have become a necessity not only to the practical gardener but to the professional botanist as well.

A STRANGE FUNGUS from Madagascar is described and figured in the *Journal of Botany* (Jan.) by George Massee. It consists of a stem-axis bearing distinct pilei which are acropetal in development. "The stem is erect, tapering upwards, and bearing several superposed circular pilei separated by elongated internodes, and becoming smaller upwards." It becomes 6 to 9 cm. high, has been taken as the type of a new genus, and bears the name *Mycodendron paradoxa*.

IN A DESCRIPTIVE LIST of Ranunculaceæ from western North America, J. Freyn in the *Deutsche bot. Monatsschrift* for last December (viii, p. 176) describes a blue form of wind flower from Washington as *Anemone cyanea*, which seems to be closely like, if not identical with, *A. Oregana* of Gray. He also distinguishes variety *strigulosus* of *Ranunculus reptans* from Oregon, and raises the British American form, *R. aquatilis*, var. *heterophyllus* Torr. & Gr., to the dignity of a species under the name *R. Grayanus*.

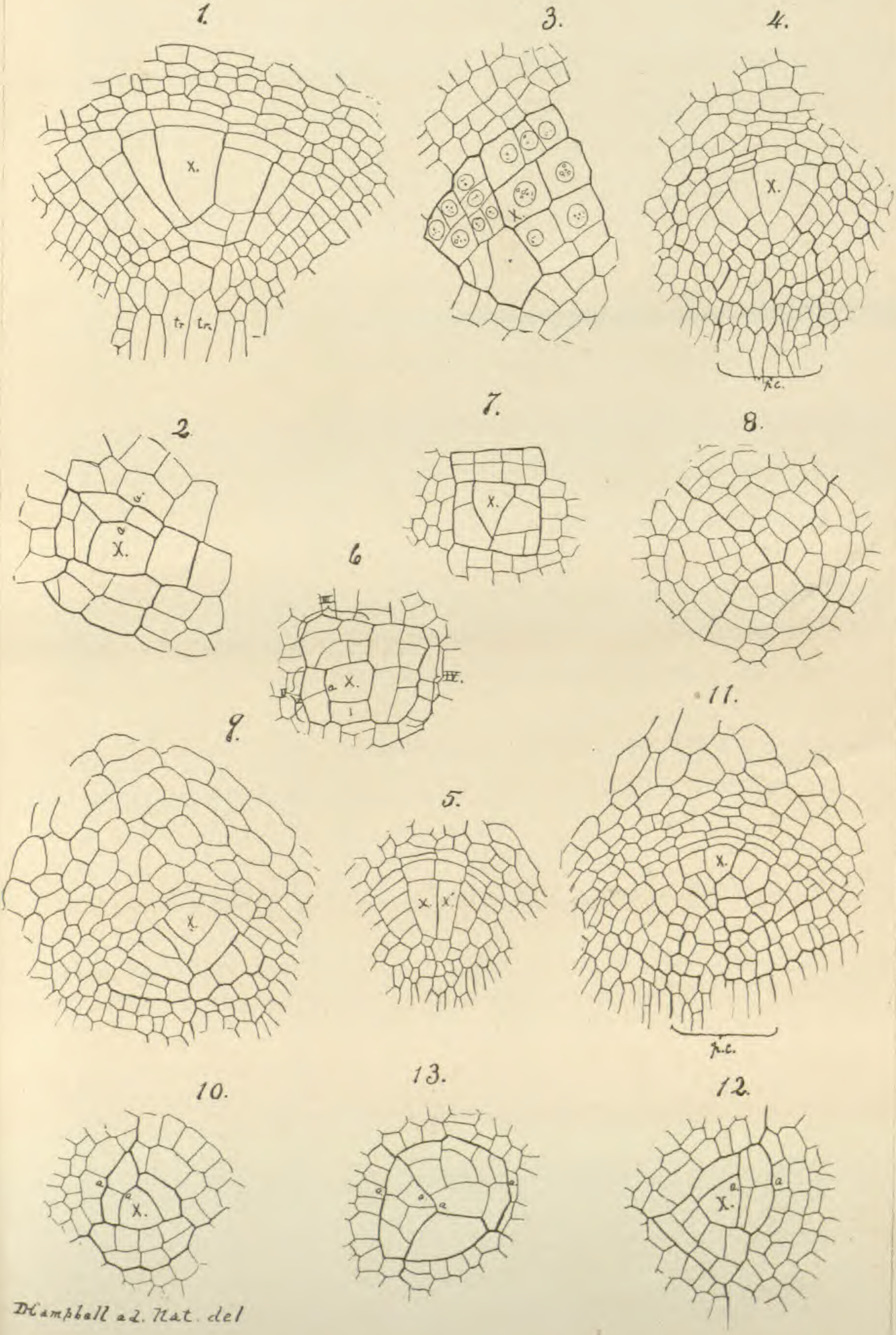
MARCEL BRANDZA has made a somewhat extended study of the anatomical characters of hybrids. Some of the peculiarities he figures (in the Revue gén. de Bot., vol. ii,) are very striking. His general conclusions are as follows: 1. Certain hybrids present in their structure a combination of the special characters found separately in the parents. 2. In other cases the structure of the different parts of the hybrid is, for all tissues, simply intermediate between the two parents. 3. Other hybrids have in certain organs an intermediate structure and in other organs a structure combining the anatomical peculiarities of the parents.

M. GASTON BONNIER began some time ago a series of experimental cultures of various plants at different altitudes in the Alps and Pyrenees (from 740 to 2400 m.) to determine the effect of Alpine conditions. He presents (Rev. gén. de Bot., ii, 513) the results of this work so far as they relate to the *facies* of the plants. As compared with plants grown in lowlands, the stature is very small; the internodes are very short; the subterranean parts are relatively much more developed; the leaves are very small and both relatively and absolutely thicker and of a darker green color; and the flowers are of more vivid hues. In a future paper he promises to show that both structure and function are correspondingly modified. The illustrations show the changes in size very strikingly.

Douliot concludes after studying a number of plants belonging to diverse families "that in the very large majority of Dicotyledons the stem is terminated by three initial cells, and in a small number of others by two initial cells only, in which case one initial is common to the bark and central cylinder. In the Monocotyledons the case of two initial cells is more frequent. In the Gymnosperms the stem has a single initial cell at its apex. The fact of having a single apical cell, together with the presence of the archegonium, allies the Gymnosperms more closely with the Cryptogams, but the presence of an independent epidermis, a common and exclusive character of both Di- and Monocotyledons, serves to connect these two groups with the Gymnosperms."— Cf. Ann. Sci. Nat. Bot., ii, 283–350.

Greeneria fuliginea, which causes the bitter rot of grapes, is not to be confounded with Coniothyrium Diplodiella or Tubercularia acinorum, according to the studies of F. Cavara (Atti Inst. bot. Univ. di Pavia, ser. II, i, p. 359; abs. in Centralblatt f. Bak. u. Parasit., viii, p. 810). Instead of belonging to the Sphæropsideæ, it goes to the Melanconieæ and to Saccardo's section Phæosporeæ. The genus characters of Melanconium agree completely with those of Greeneria. C. therefore proposes to place the fungus under that genus with the following diagnosis: *Melanconium fuligineum* (Scribner & Viala) Cavara. Acervulis sparsis griseo-cinereis, epidermide tectis, dein in fissuris ellipticis erumpentibus; conidiis continuis, ovoideis vel ellipsoideis utrinque acutiusculis, dilute fuligineis, in muco atro immersis, stromate parenchymatico conoideo, albido, suffultis, $7.5–9 \times 4–4.5 \mu$.

Oscar Eberdt sets forth (Prings. Jahrb. für wiss. Bot., xxii, 293) his observations on the formation of starch grains, which differ from the well known ones of Schimper on the function and destiny of the leucoplasts. It would seem from his investigations that there is differentiated from the plasma certain bodies of small size and of proteid-like material which he designates as "Stärke-Grundsubstanz"—*proamyloid*—because they act as the basis for the formation of the grain. These are bordered or surrounded by a covering of plasma. The first starch recognizable by the iodine test appears in the proamyloid which diminishes as the grain and the plasma coat increases. The grain presently enlarges sufficiently to break through the plasma coat which then remains as a cap. The grain continues to grow as long as this cap is present. After it is lost no more growth is possible. Grains so formed will be excentric. Concentric grains are formed inside a plasma coat which they do not rupture. Stratification does not appear until the grain breaks or is freed from the plasma. It is, according to Eberdt, only the plasma coat or cap which can properly be called the starch former. The proamyloid is passive. Eberdt controverts the view that the leucoplasts may be converted into chloroplasts under the influence of light.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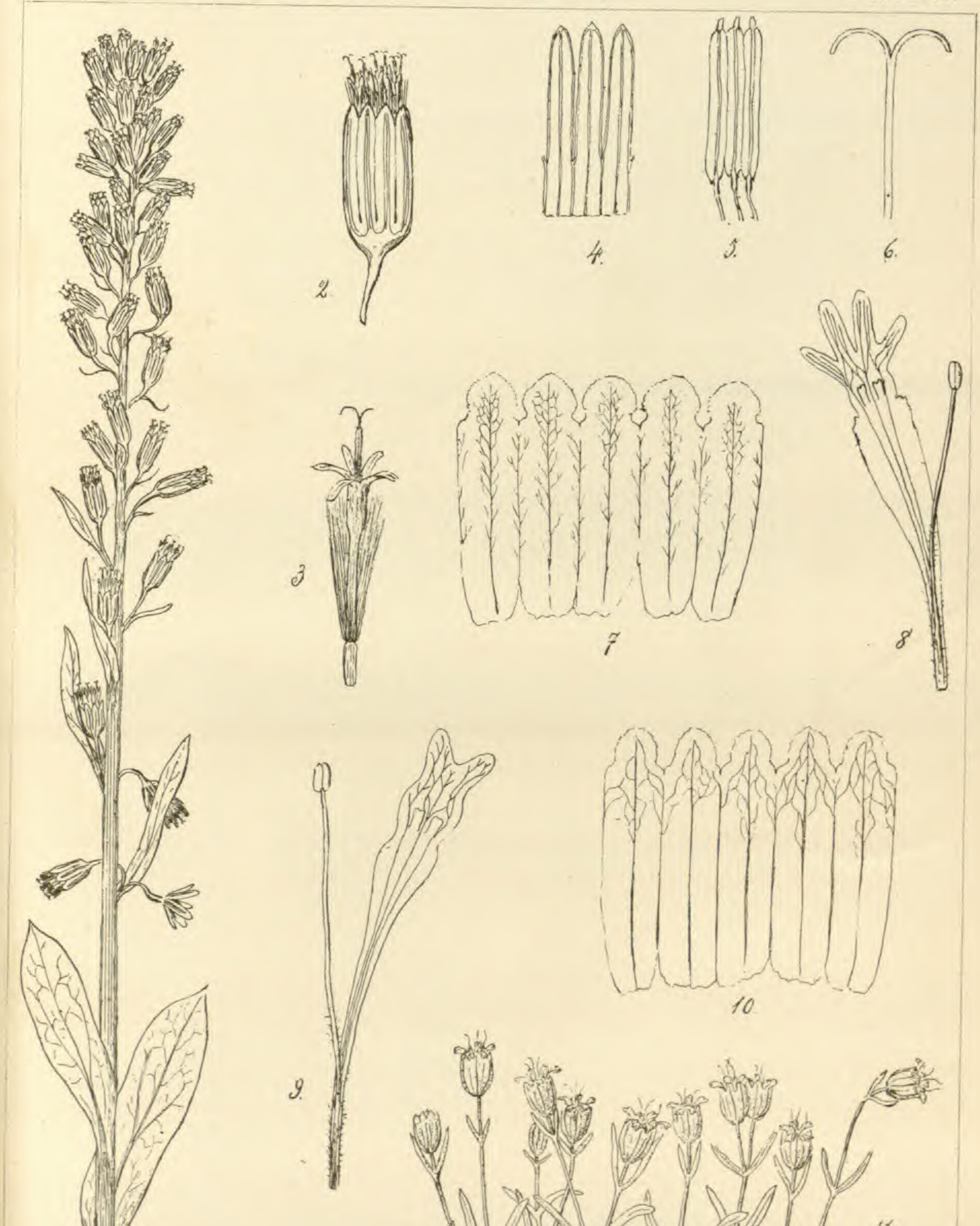
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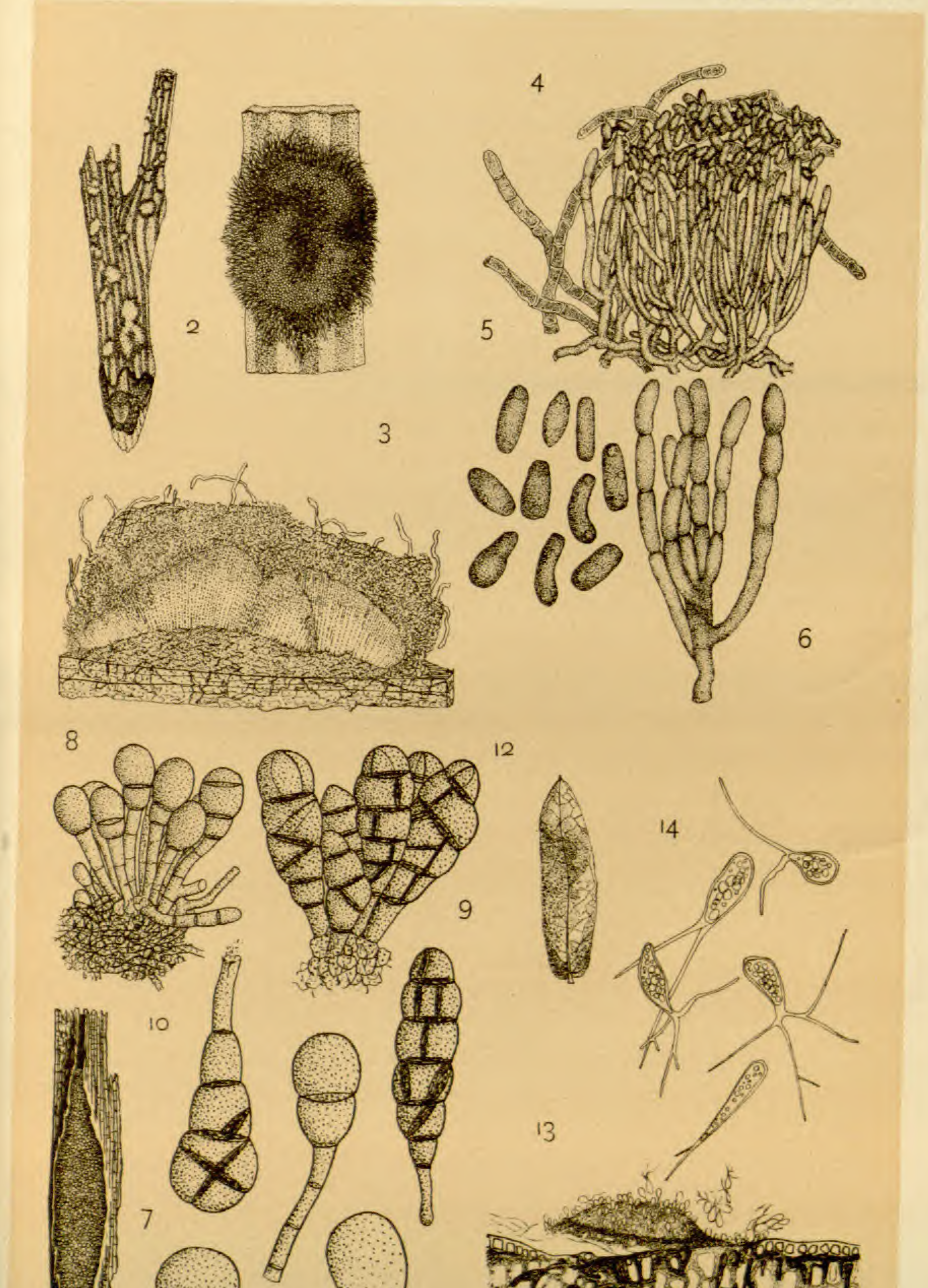
ROBINSON on LUINA and SILENE.

BOTANICAL GAZETTE, 1891

PLATE ~~I.~~ VII.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VOL. XVI. MARCH, 1891. NO. 3.

THE BOTANICAL GAZETTE

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[ISSUED MARCH 16.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

THE BOTANICAL GAZETTE.

A Monthly Journal Embracing all Departments of Botanical Science.

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VOL. XVI. NO. 3.—BOTANICAL GAZETTE.—MAR., 1891.

Black rust of cotton: a preliminary note.[1]

GEO. F. ATKINSON.

Early in the past season I began a study of the fungous diseases of the cotton plant with the special object to determine the disease called "black rust." The first of August, 1890, one hundred circular letters were sent to different farmers of Alabama requesting specimens of "black rust," "red rust," "Frenching," "root rot," etc. As it seemed probable that there was some confusion in the application of these names to certain appearances of the cotton a special request was made of the senders to carefully label the plants with the name applied by them to the disease.

From twenty-five to thirty replies were received including specimens marked "black rust," "red rust," and "root rot."[2]

The disease has been very prevalent and destructive during the season and excellent opportunities were afforded me for studying it in the vicinity of Auburn, not only upon the station farm but on neighboring plantations.

July 22d, on one of my visits to the cotton field, I found the disease had made its appearance in full force in several spots, where fully one-half of the leaves of the plants had fallen off, the remainder being curled, dried, and blackened by a profuse development of dark hyphæ and spores of several fungi, so that by suddenly jarring a leaf the spores would float off in clouds like the smut spores of some of the Ustilagineæ. Some of the plants showed still the earlier stages of the disease, and in other parts of the field were numerous opportunities to study the earlier stages. For two months my time was occupied in noting the external characters, collecting material, examining the different fungi found and noting the relation of each species to the variety of external characters presented in the progress of the disease.

---

[1] Paper read before the American Association of Agricultural Colleges and Experiment Stations, Champaign, Ill., Nov., 1890.

[2] The "root rot" disease was reported from only one place. The effects of the disease upon the plant are strikingly similar to those produced by the Texas disease which is caused by *Ozonium* according to Pammel, but due to an entirely different organism, a nematode worm, *Heterodera radicicola*.

The fungi commonly present and which play an important part in the disease are *Cercospora Gossypina* Cooke, a species of *Colletotrichium*,[1] a *Macrosporium*,[2] an *Alternaria*, and frequently a pycnidial stage of some sphæriaceous fungus,[3] and a bacterial organism which produces a characteristic disease of the leaves.

The bacterial disease is often very widely spread even when no evidences of the other fungi are to be found, but is mentioned here because frequently it is an accompaniment of the "black rust" and contributes materially to the aggravation of the disease. It is first manifested by a watery appearance in definite areolate spots which are bounded by the veinlets of the leaf. The spots are sometimes very numerous and frequently conjoined; often the disease follows one or more of the main ribs of the leaf being bounded on each side by an irregularly zigzag line. As the disease ages the spots become blackish and finally brown, frequently then bordered by a blackish color where the disease has extended somewhat centrifugally. The disease hastens the falling off of the leaves.

During the entire season, from July to the close of October, of the thousands of leaves old and young that I have examined, Cercospora Gossypina has been an almost universal accompaniment, and has not been second in point of attack, except perhaps in rare cases. In many cases parallel or immediately succeeding attacks were made by the Colletotrichium. The Macrosporium as a rule follows closely the attack of the Cercospora,[4] indeed sometimes seeming to be the first to attack. In such cases possibly it attacked the spots diseased by Cercospora before the hyphæ and conidia of the latter were developed. The Alternaria usually succeeds the Macrosporium, though often seeming to be parallel with it. By its numerous clusters of hyphæ and profusely developed concatenate spores in favorable weather the leaf is soon covered with a mass of spores giving a blackened appearance to the leaves.

---

[1] *C. Gossypii* E. A. Southworth.

[2] This seems to be an undescribed species for which I have proposed the name *Macrosporium nigricantium*. The hyphæ are amphigenous, subfasciculate or scattered .050–.140 mm. long × .006–.007 mm. in diameter, nodulose, septate, olive brown. Conidia .018–.022 mm. × .036–.050 mm. strongly constricted about the middle, stoutly rostrate at one side of the apex, smooth, transversely longitudinally and obliquely septate, olive brown. The nodulose hyphæ resemble those of such species as *M. parasiticum* Thuem.

[3] This is probably *Phyllosticta Gossypina* E. & M. Some recent cultures in agar-peptone broth and an infusion of cotton leaves seem to show that it is the pycnidial stage of an undescribed *Pleospora* which I have found on cotton leaves.

[4] Possibly also that of the Phyllosticta.

My correspondents in Alabama use the term "black rust" when the disease progresses very rapidly and the development of the hyphæ of Cercospora and setæ of Colletotrichium, or the Macrosporium and Alternaria spores, is very profuse causing the leaves to appear black. When the disease progresses more slowly, being checked by unfavorable weather, or is in the first stages, the term "red rust" is used. In such cases the Macrosporium or Alternaria has extended centrifugally the spots attacked by the Cercospora, increasing their size, causing them to become more nearly circular, and marking the spots with concentric lines. Also the edges of the leaf are dead and dried, and curled either below or upward, being favorite places for the attack of either the Cercospora or Colletotrichium. The body of the leaf is still green, paled by different shades of a dull yellow or dull purple.

In some cases in the early stages of the disease the Colletotrichium severely attacks the upper part of the stem of the plant and petioles of the leaves giving the stems a dark color from the internal changes, to the leaves a scalded appearance and causing them to shrivel and dry up much as if frost-bitten.

Sometimes the development of Cercospora may be so great and the attack of the other fungi so tardy as to give the appearance of "black rust" produced by it alone. Specimens of this kind were received from one of my correspondents at Eutaw, Ala. The conditions for the development of Cercospora were so favorable that from one-fourth to three-fourths of the leaf surface was covered with a dense mass of the dark brown hyphæ, the remaining portion of the leaf being yellowish with numerous small points of attack. The hyphæ and conidia in such cases are very long, often five to eight times as long as described by Cooke. Specimens collected at a later date at this place gave an abundance of the Macrosporium and Alternaria.

Where other fungi, as Colletotrichium, Macrosporium and Alternaria are abundant, it is often very difficult to find the Cercospora on the leaf. By placing the leaves, freshly gathered, in moist chambers for ten or twelve hours I have never failed to get an abundance of Cercospora, even on the smallest, uppermost leaves of the plant. Sometimes the Macrosporium is the predominating fungus in the last stages of the disease giving a black appearance to the entire leaf.

Much speculation in agricultural papers has been indulged in regarding the cause of "black rust" of cotton. It is not proposed in this preliminary note to critically examine the various theories propounded. Some of my correspondents who formerly attributed the disease to the peculiar condition of the soil, lack of fertilizers, etc., say that sometimes in the best soil and with careful fertilizing the disease appears in a very destructive form. That has been abundantly proven during the past year under my own observation. Cercospora, Colletotrichium and Phyllosticta are all active parasites, and I am convinced from a year's study that Cercospora Gossypina is a more active and destructive parasite than has been formerly regarded. A diseased condition once started by such a fungus opens the way for the rapid growth and great injury produced by such forms as Macrosporium and Alternaria. It is possible the Macrosporium may infect the leaves unaided by other fungi. Inoculations of plants free from other forms must be made to determine this.

Cercospora Gossypina sometimes produces a serious spot disease of the cotyledons. I first observed this on some young plants started on the horticultural grounds, in September, for experimental purposes. I am told that sometimes in cold seasons in May this spot disease is quite injurious along with "sore shin."

While in North and South Carolina my attention was called to a disease termed "red rust" which was chiefly characterized by a reddening of the leaves not produced nor accompanied by any fungous growth. In most cases this seems to be due to some condition of the soil which induces a hastened maturity of the plant and the development of erythrophyll in the cell sap of the leaves. In some cases the development of erythrophyll is induced by the irritation of mites as I have proved by infection experiments. From several places in both states cotton quite severely injured by mites has been sent me. An account of this was published in Bulletin no. 4 of the South Carolina Agricultural Experiment Station, January, 1889.

The reddening of the leaves by the development of erythrophyll in the cell sap of the leaves is very common in some soils in Alabama and probably in all the cotton-producing states. It is quite possible that all through this belt there are those who term this the "red rust," but so far as I have been able to learn by talking with farmers in Alabama, and from the specimens received, the term here is applied to the early, or arrested stages of "black rust" as I have described above.

Auburn, Ala.

Flowers and insects. VI.

CHARLES ROBERTSON.

Triosteum perfoliatum L.—In the bud the style is bent and the stigma is pressed against the opposing lobes of the corolla. As soon as the lobes separate the style straightens and the stigma is thrust out. The stigma rises from 3 to 4 mm. above the anthers and appears to be receptive while they are still indehiscent, so I regard the flower as proterogynous. The corolla continues to lengthen until the second stage. In this stage the anthers are dehiscent, and the stigma is turned to one side. The flowers are rather dark purple and collected in inconspicuous clusters in the axils of the perfoliate leaves. Nectar is secreted in a gibbosity in the base of the corolla. The corolla is from 14 to 16 mm. long and is adapted to long-tongued bees.

Visitors: (May 18 and 23) *Apidae:* (1) Bombus Ridingsii Cr. ♀, s.; (2) B. vagans Sm. ♀, s., visited all of the open flowers and forced its proboscis into several buds, whose lobes had hardly begun to loosen, but which contained an abundance of nectar; (3) B. americanorum F. ♀, s.; (4) Anthophora abrupta Say ♂, s,; *Andrenidae:* (6) Augochlora pura Say ♀, s. and c. p., crawls into the tube; (7) Halictus Lerouxii St. Farg. ♀, c. p.

Cephalanthus occidentalis L.—The first peculiarity of the flower that strikes one is the great difference in the height of the anthers and stigma. Indeed, it looks like a long-styled dimorphous flower. The anthers are at the mouth of the tubular corolla, while the stigma rises 7 mm. higher. It looks as if the pollen could never touch the same part of the insect which comes in contact with the stigma. The disparity is accounted for by the fact that the style itself serves to expose pollen to the visitors. In the bud the anthers dehisce, depositing all of their pollen in a conical mass upon the summit of the style. The style rises to its usual height and holds the pollen where it will easily touch insects lighting upon the globular head of flowers. After the pollen has been removed, the stigma becomes receptive, and the flower is now in the second or female stage.

Meehan[1] has taken the loading of the pollen upon the tip of the style as a plain case of self-fertilization. But it is no more a case of self-fertilization than the loading of pollen upon the style brush of Campanula. As far as they go, Meehan's observations do not support the view that self-fertilization occurs even in absence of insects, for he says: "Numerous seeds are in every head examined. Carefully dissecting one, I found it had 279 flowers, of these 225 perfected seeds, and only 54 failed." He had made the gratuitous assumption that fullness of fruit is evidence of self fertilization.[2] As between cross and self fertilization, the 225 fruitful cases prove nothing; the failure of one in five flowers is presumptive evidence against the power to self-fertilize.

The round heads of white flowers are very attractive to insects. The corolla tubes are 9 mm. long and are very narrow, especially below. The flowers are thus adapted to long and thin tongues. The nectar rises in the tube so that shorter tongued insects can reach some of it, but the predominant visitors are butterflies. On 11 days, between July 5th and August 17th, I observed the following visitors:—

Hymenoptera — *Apidae:* (1) Apis mellifica L. ☿, s., ab.; (2) Bombus virginicus Oliv. ☿, s. and c. p., freq.; (3) B. separatus Cr. ♂♀☿, s., ab.; (4) B. Ridingsii Cr. ♂, s., one; (5) B. americanorum F. ♂♀☿, s. and c. p., ab.; (6) B. pennsylvanicus De Geer, ♀☿, s., freq.; (7) B. scutellaris Cr. ☿, s., one; (8) Emphor bombiformis Cr. ♀, s., one; (9) Xenoglossa pruinosa Say ♂, s.; (10) Melissodes obliqua Say ♀, s.; (11) M. bimaculata St. Farg. ♂, s.; (12) Ceratina dupla Say ♀, s.; (13) Megachile mendica Cr. ♀, c. p.; (14) Nomada texana Cr. ♀, s.; *Andrenidae:* (15) Halictus Lerouxii St. Farg. ♀, s., one; (16) H. ligatus Say ♀, s., one; (17) Agapostemon nigricornis F. ♀, s.; (18) A. radiatus Say ♂, s.; (19) A. texanus Cr. ♀, s.; (20) Prosopis affinis Sm. ♀, f. p.; *Pompilidae:* (21) Priocnemis fulvicornis Cr., s., one; *Scoliidae:* (22) Myzine sexcincta F. s., one.

---

[1] Contributions to the Life Histories of Plants. Proc. Acad. Nat. Sci. Phila., 1887, 323-333; 4 figs. See also Bull. Torr. Bot. Club, xv, 54.

[2] Bot. Gazette xiii, 157.

Lepidoptera—*Rhopalocera:* (23) Papilio philenor L.; (24) P. asterias F., ab.; (25) P. troilus L.; (26) Pieris protodice Bd.-Lec.; (27) P. rapae L.; (28) Colias caesonia Stoll; (29) C. philodice Godt.; (30) Danais archippus F. ab.; (31) Argynnis cybele F.; (32) Phyciodes tharos Dru.; (33) Pyrameis atalanta L., ab.; (34) P. huntera F.; (35) P. cardui L.; (36) Limenitis disippus Godt.; (37) Satyrus alope F.; (38) Thecla humuli Harr.; (39) Chrysophanus thoe Bd.-Lec., ab.; (40) Lycaena pseudargiolus Bd.-Lec.; (41) L. comyntas Godt.; (42) Pamphila zabulon Bd.-Lec.; (43) P. huron Edw.; (44) P. peckius Kby.; (45) P. cernes Bd.-Lec.; (46) P. delaware Edw.; (47) Nisoniades juvenalis F.; (48) Eudamus tityrus F., ab.; *Arctiidae:* (49) Utetheisa bella L.; *Pyralidae:* (50) Scepsis fulvicollis Hübn.—all s.

Diptera—*Conopidae:* (51) Physocephala tibialis Say, s.; *Syrphidae:* (52) Sphaerophoria cylindrica Say, s.; (53) Volucella evecta Walk., s.; (54) Eristalis tenax L., s., ab.; (55) E. latifrons Lw., s. and f. p.; (56) Syritta pipiens L., s.; *Muscidae:* (57) Musca domestica L., f. p.

Coleoptera—*Coccinellidae:* (58) Hippodamea 15-maculata Muls., f, p.; *Scarabaeidae:* (59) Trichius piger F., f. p.

Hemiptera—*Lygalidae:* (60) Oncopeltes fasciatus Dall., s.

Lobelia[1] *spicata* Lam.—In my neighborhood this is the earliest blooming Lobelia. The plants are scattered and are neither so attractive to insects nor so easily observed as the next species. The flowers are white and are arranged in rather loose spikes. They are proterandrous, like the other species which have been observed. The corolla tube is 4–6 mm. long, and the nectar is therefore only readily accessible to tongues of medium length.

Visitors: (5 days, May 31 to June 12) Hymenoptera—*Apidae:* (1) Ceratina dupla Say ♀; (2) Megachile brevis Say ♀; (3) Alcidamea producta Cr. ♀.

Lepidoptera—*Rhopalocera:* (4) Pieris protodice Bd.-Lec.; (5) P. rapae L.; (6) Chrysophanus thoe Bd.-Lec.; (7) Ancyloxypha numitor F.; (8) Pamphila peckius Kby.; (9) P. cernes Bd.-Lec.—all s.

Lobelia leptostachys A. DC.—Resembles L. spicata, but the spikes are more conspicuous, and the corolla tubes are a little longer. On account of later blooming, the list shows less of the genus Melissodes and an increase in Megachile.

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[1] On the fertilization of Lobelia see Mueller: Fertilization of Flowers, 365, 633.

Visitors: (7 days, July 8 to 31) Hymenoptera—*Apidae:* (1) Apis mellifica L. ☿, s.; (2) Bombus separatus Cr. ☿, s.; (3) B. americanorum F. ☿, s.; (4) Melissodes obliqua Say ♂, s.; (5) M. bimaculata St. Farg. ♂, s; (6) Ceratina dupla Say ♀, s.; (7) Megachile rufimanus Rob. (MS) ♂, s.; (8) M. brevis Say ♂♀, s. and c. p.; (9) M. petulans Cr. ♂, s.; (10) M. exilis Cr. ♂, s.; (11) Anthidium emarginatum Say ♂♀, s.; (12) Andronicus cylindricus Cr. ♀, s.; (13) Coclioxys 8-dentata Say ♂, s.; *Andrenidae:* (14) Agapostemon nigricornis F. ♀, s.; (15) Augochlora pura Say ♂♀, s., the male sucking through the slit in corolla; (16) Halictus fasciatus Nyl. ♂, s.; (17) H. pilosus Sm. ♀, c. p.

Lepidoptera—*Rhopalocera:* (18) Lycaena comyntas Godt.; (19) Pamphila cernes Bd.-Lec.; (20) Nisoniades juvenalis F.—all s.

Diptera—*Bombylidae:* (21) Systoechus vulgaris Lw., s.

Lobelia syphilitica L.—The large blue flowers are specially adapted to bumble-bees. Delpino saw it visited by Bombus italicus and B. terrestris. In this country Trelease[1] saw it visited by several species of Bombus. As intruders he observed Osmia sp. and Ceratina dupla Say ♀ collecting pollen.

Visitors: (4 days, Aug. 12 to Sept. 3) *Apidae:* (1) Bombus separatus Cr. ♀, s.; (2) B. virginicus Oliv. ☿. s. and c. p.; (3) B. vagans Sm. ☿, s. and c. p.; (4) B. americanorum F. ♀☿, s., ab.; *Andrenidae:* (5) Augochlora pura Say ♀; (6) Halictus connexus Cr. ♀—both collecting pollen which they work out of the anther-tube with their jaws and front feet.

Lepidoptera—*Rhopalocera:* (7) Danais archippus F.; (8) Papilio philenor L.—both s.

Lobelia cardinalis L.—Trelease (*l. c.*) saw this flower visited by humming-birds, Trochilus colubris L. I have never failed to find them about the flowers, and there is no doubt that the flowers are specially adapted to them. The pendant lip shows that the flower is intended to be visited by a bird or insect which is in the habit of sucking the sweets from flowers without resting upon them. I have also seen the flowers visited by Papilio philenor L. and P. troilus L.

On two occasions I counted five individuals of Bombus americanorum F. ☿, about the flowers. Sometimes one of them would try to reach the nectar in front, but failing, would crawl down to the base of the flower and insert its tongue through the slit, but most of them only tried to reach the nectar through the slit. This is the only time I have seen a bumble-bee obtaining nectar illegitimately.

---

[1] On the fertilization of several species of Lobelia, Am. Nat. xiii, 427–432.

Augochlora pura and Halictus connexus also visit this plant for pollen, behaving as on the flowers of L. syphilitica.

Since the flowers of Lobelia are intended to be visited by insects entering below the stamen tube it is an imperfection that the tube has openings between the bases of the upper filaments, for this allows improper visitors to steal the nectar through the slits in the upper side of the corolla. Trelease saw Augochlora pura treating flowers of L. erinus in this way and I have observed the same thing in L. leptostachys and L. cardinalis.

Lobelia cardinalis × *syphilitica.*—Very many plants of the two preceding species grew together in a large patch. The ruby-throated humming-bird passed by L. syphilitica and only visited L. cardinalis. The bumble-bees visited L. syphilitica regularly, only stealing the nectar of L. cardinalis in the cases indicated; and they might not have done so, if they had not been drawn among them by L. syphilitica.

The insects which occurred on both species and which effect hybridization are Bombus americanorum, Augochlora pura, Halictus connexus and Papilio philenor.

Among the plants I found nine specimens of the hybrid. The corolla is shorter and broader and the lobes shorter and firmer than in L. cardinalis, and is described by Schneck[1] as of a deep reddish or crimson-purple. There is abundant nectar, but the others seem imperfect.

Twice I saw Bombus americanorum visit the flowers in the regular way, showing that it could reach the nectar easily. This led me to wonder if the humming-bird would visit the hybrid. Seeing one alight upon a limb over my head, I drew back and was rewarded by seeing him come down and visit the hybrid along with L. cardinalis. It was interesting to observe that, while Bombus americanorum could not suck the nectar of L. cardinalis properly and humming-birds did not visit L. syphilitica at all, the nectar of the hybrid was easily accessible to the one and its colors were attractive to the other.

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[1] Bot. Gaz. iii, 35.

Campanula Americana L.[1]—In the GAZETTE, xiii, 225, I have observed that this flower is in the first stage of irregularity, and that bees land upon the style and insert their tongues between the bases of the upper stamens. But, although the stigma is turned so as to strike the ventral surface of the bee, the stamens still retain the useless habit of covering the style on all sides with pollen. At first the style is straight so that the bee touches only the upper side, but afterwards it bends so that the bee may touch the sides and even the underside near the tip. But still much pollen is wasted by being fixed on the lower side. Megachile exilis, which visits the flower for pollen, regularly turns and hangs under the style so as to clean the pollen off the lower side. This is another illustration of the fact that in dichogamous flowers, which as a rule are only properly visited for nectar, the pollen often acts disadvantageously by attracting insects which remove it and neglect the flowers in the female stage.

The larger bees, which are the only insects adapted to the flower, visit it only for nectar and only touch the upper side of the style. I repeat the list given in the GAZETTE, l. c., with some additions.

Visitors: (11 days, July 10 to Aug. 28) Hymenoptera—*Apidae:* (1) Apis mellifica L. ☿; (2) Bombus virginicus Oliv. ♂☿; (3) B. separatus Cr. ♂; (4) B. americanorum F. ♂☿; (5) Melissodes bimaculata St. Farg. ♂♀; (6) Megachile brevis Say ♂☿—all sucking; (7) M. exilis Cr. ♂♀, s. and c. p.; *Andrenidae:* (8) Agapostemon radiatus Say ♂♀, s; (9) Augochlora pura Say ♀, c. p.; (10) Halictus Lerouxii St. Farg. ♂, s.; (11) H. coriaceus Sm. ♂♀, s; (12) Prosopis affinis Sm. ♀, f. p.; *Specidae:* (13) Ammophila sp. searching for nectar; *Scoliidae:* (14) Myzine sexcincta F. s.

Lepidoptera—*Rhopalocera:* (15) Pyrameis cardui L. s.; (16) Pholisara hayhurstii Edw., s.

Apocynum[2] *cannabinum* L.—The flowers are white, much smaller than in A. androsæmifolium, and the nectar is lodged in rather shallow receptacles, so that flies and other short-lipped insects can reach it. A. androsæmifolium, according to Ludwig, is visited by butterflies and cements its pollen to their tongues. I have found the pollen-masses of this species on the maxillary and labial palpi of bees, and but rarely on other parts of their tongue. The insects in the list are marked m. l. or t. according as the pollen masses were found on the maxillary or labial palpi, or on the ligula proper.

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[1] See Barnes: Bot. Gaz. x, 349, pl. x and vol. xi, 99.

[2] On literature of genus see Mueller: Fertilization of Flowers, 396, 631.

Visitors: (June 21, 25) Hymenoptera—*Apidæ:* (1) Apis mellifica L. ☿, l.; (2) Coelioxys 8-dentata Say ♂♀; (3) Stelis lateralis Cr. ♀; (4) Nomada articulata Sm. ♂, m. l.; (5) N. incerta Cr. ♀, m. l.; *Andrenidæ:* (6) Macropis steironemæ Rob. (MS) ♂♀; (7) Agapostemon radiatus Say ♀, m.; (8) Augochlora lucidula Sm. ♀; (9) Halictus fasciatus Nyl. ♀; (10) H. connexus Cr. ♂♀; (11) Colletes sp. ♂, m.; (12) Prosopis affinis Sm. ♀; *Eumenidæ:* (13) Odynerus foraminatus Sauss. t.; *Bembecidæ:* (14) Monedula ventralis Say; *Larridæ:* (15) Astata bicolor Say; *Sphecidæ:* (16) Ammophila vulgaris Cr.; (17) Isodontia philadelphica St. Farg., t.; (18) Priononyx thomæ F.; (19) P. atrata St. Farg.

Diptera—*Mycetophilidæ:* (20) Sciara sp.; *Bombylidæ:* (21) Anthrax alternata Say; *Syrphidæ:* (22) Allograpta obliqua Say; (23) Sphærophoria cylindrica Say; (24) Tropidia mamillata Lw.; (25) T. quadrata Say; *Empidæ:* (26) Empis sp.; *Tachinidæ:* (27) Cistogaster divisa Lw.; (28) Ocyptera sp.; (29) Jurinia apicifera Walk.; (30) Micropalpus sp.; (31) Acroglossa hesperidarum Will.; *Sarcophagidæ:* (32) Sarcophaga sp.; *Muscidæ:* (33) Lucilia caesar L.; (34) L. macellaria F.; *Anthomyidæ:* (35) Anthomyia sp.; (36) Limnophora sp.

Lepidoptera—*Rhopalocera:* (37) Argynnis cybele F.; (38) Thecla calanus Hübn.

Coleoptera—*Scarabaeïdae:* (39) Trichius piger F.

Hemiptera—*Capsidae:* (40) Lygus pratensis L.; *Lygaeidae:* (41) Lygæus turcicus F., s.

Carlinville, Ill.

Notes on technique. II.

JAMES ELLIS HUMPHREY.

In the study of zoöspores, especially those of Fungi, it is not always easy to demonstrate clearly the number and attachment of the cilia. The iodine preparations usually recommended for that purpose have not proved satisfactory with me on account of their tendency to shrivel and distort the body of the zoöspore. In some cases, too, they have not acted with sufficient promptness to fix the spore at precisely the right instant. In view of these facts attempts have been made to find a more satisfactory method of treatment, and I have adopted after numerous trials a combination somewhat different from any which I have seen suggested, though it involves nothing new in principle.

The zoöspores, in water under a supported cover-glass, are instantly killed by placing at the edge of the cover a couple of drops of a one per cent. solution of osmic acid. This is left for a few minutes to fix the spores thoroughly, which it does without the least distortion, and is then drawn off by means of filter-paper. It is not necessary to wholly remove the acid or to pass water under the cover before applying the staining fluid, which consists of a drop of a moderately strong solution in 90 per cent. alcohol of Hanstein's rosanilin-violet, composed of equal parts of fuchsin and methyl-violet. This stains the cilia and the bodies of the zoöspores of both Algae and Fungi very quickly and deeply, as well as sharply, showing the number and insertion of the cilia as plainly as a drawing, and giving a clear image with the camera lucida.

It is very possible that other stains would serve equally well, but I have not taken time nor has it seemed worth while to seek further in view of the uniformly good results obtained as described. For killing and fixing, I think there is nothing quite so good in all respects as osmic acid.

By means of the above treatment I have had no difficulty in demonstrating the correctness of the statements of Cornu[1] and Hartog[2] that the zoöspores of *Achlya* are ciliate, at least in some cases, when they escape from the zoösporangium, as are those of *Saprolegnia*. This statement is directly opposed to those of other writers and to those of the leading text-books,[3] which state that the zoöspores of *Achlya* escape from the sporangium *without cilia*. My observations were made on a form related closely to *A. polyandra* (perhaps that species), and seem to me entirely conclusive. The discussion of the details of the structure of the zoöspores and of the bearings of the fact stated is reserved for a future occasion; but it may be remarked here, as has been done by the previous writers, that the establishment of the diplanetism of *Achlya* brings it much closer to *Saprolegnia.* Indeed the structural differences between them become reduced to a single one; namely, that while in *Achlya* the sporangia formed from a filament arise after the first one by lateral outgrowth below the basal walls of the previous ones, in *Saprolegnia* they usually arise inside of the preceding ones by the upward growth of the successive basal walls. But I have seen, in an undetermined species of *Saprolegnia*, the formation of secondary sporangia after the *Achlya* type on a few filaments. There remain to be noticed two physiological differences so closely connected as to constitute, perhaps, a single phenomenon. The first swarming period in *Achlya* is reduced to its lowest terms, and at its close the zoöspores become aggregated into a hollow sphere at the mouth of the sporangium, in response to an apparent mutual attraction which Hartog[1] has termed adelphotaxy. Is this mutual attraction the cause of the shortness of the first swarming period?

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[1] Ann. Sci. Nat. ser. 5, tom. xv, p. 1.

[2] Quart. Journ. Mic. Sci. vol. xxvii, p. 427.

[3] Cf. De Bary: *Vergl. Morphol. u. Biol. d. Pilze*, p. 116, and Engl. transl. p. 108; Zopf: *Die Pilze*, p. 294.

Amherst, Mass.

A contribution to the life history of Hydrastis Canadensis.

HOMER BOWERS.

(WITH PLATE VIII.)

About ten years ago while engaged in the cultivation of various indigenous plants and the study of their germination and growth some deviations were observed in the behavior of Hydrastis Canadensis so at variance with the accepted view of the life history, that a minute study of all its peculiarities was begun and from that time to the present it has been followed with the view of bringing the facts to the attention of botanists.

My attention was first drawn to the plant specially, on discovering a stage in its growth concerning which no record exists. Afterwards when investigation disclosed that this unknown stage embraces a feature anomalous in the growth of plants, a great incentive for further research was added. This at length brought to light two other important facts that seem never to have been noticed, besides several minor points that are unrecorded, together with some slight errors of observation or description. The proper statement of these facts necessitates an account of the life history.

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[1] Annals of Botany, vol. ii, no. vi, p. 216.

SYNOPSIS OF THE LIFE HISTORY.—Hydrastis Canadensis is a perennial herb found growing in patches in rich open hilly woods, and on the slopes along the wooded bluffs and secondary banks of streams. The seed naturally sown after the ripening of the fruit in July or August, does not germinate until the following spring, about the last week in April, or the first in May. The plantlet consists of a pair of orbicular cotyledons on long spreading petioles, joined to a slender radicle, and makes no further advance in growth the first year of its life, other than the development of the cotyledons, together with the attached radicle, surmounted by a large bud. The seed-leaves alone do duty for foliage during the whole growing period of this stage of its existence.[1]

The second year it sends up a single rounded, palmately-lobed leaf on a footstalk articulated at the root. This stage often persists through the third year; the plant then sends up a larger radical leaf, with perhaps one or more smaller ones in addition.

The third or fourth year the stem arises 15 to 30 or more cm. high, having two alternate leaves, with two-ranked arrangement, the lower larger and petioled, the upper sessile at the junction of the peduncle of the flower with the stem of the plant.

It has thus three stages of growth, being acaulescent for two or more years, and bearing fruit the third or fourth year. The bud-scales found at the base of the stem are two-ranked, conduplicate, and equitant. Under certain conditions it propagates itself by adventitious buds from fibrous roots. There are also evident stipules.

DETAILED DESCRIPTION.—*First stage, duration one year.*—The cotyledons on first appearing are bright emerald green, glossy, oval, about 5 mm. broad and 6 mm. long. The petioles are long and somewhat thickened; the radicle long and slender. The cotyledons attain their full size in about three weeks, when they measure 8 to 12 mm. in diameter. In general outline they are now orbicular, and slightly emarginate, with three basal nerves, well defined on the under surface, and of a dull green color. The petioles are now long, slender, slightly pubescent, somewhat divergent, and joined to the radicle 6 to 12 mm. below the surface.

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[1] Rarely, in a very vigorous seedling, a small radical leaf on a short footstalk will be sent up late in June or early in July, and also in a few instances where seedlings have been transplanted at an early stage to a more favorable location, a small radical leaf has been observed to spring up.

In August or September, after the first stage of growth has been completed, the plant consists of the following parts: A few fibrous roots at irregular intervals along a thickened and tapering radicle, from the summit of which a small yellow bud arises about 4 mm. in height; and the two foliaceous cotyledons, showing evidence of maturity and decline, with their petioles inserted at its base.

Second stage, duration one or two years.—The rootstock is small, erect, somewhat conical, and continuous with what constituted the radicle of the first year, which gives off several fibrous roots. There is no stem as yet, and the single leaf is round-cordate, sometimes partially peltate, palmately five-lobed, doubly serrate, with a cup-like depression at base, sits horizontally on a footstalk 5 to 15 cm. long that is articulated on the rootstalk, and has evident stipules.

Third stage, duration indefinite.—The rhizome is knotty, variously contorted, erect, with many long fibrous roots of a bright orange color. The stem arises from a terminal bud 15 to 30 cm. or more high, 4 to 6 mm. in diameter, erect, round, more or less pubescent, yellow below the surface, becoming purplish from the point of exposure to light a short distance upward. Three and sometimes four bud-scales embrace the base of the stem, the inner much the largest. They are conduplicate, equitant, strongly keeled, hooded, mucronate, 10 to 15-nerved, the lateral margins membranaceous. They arise from nodes 4 to 6 mm. apart, and are yellow, becoming purplish if exposed at the surface, and are homologous with stipules. The leaves are now two, rarely three, alternate, with two-ranked arrangement, and plicate vernation. The lower leaf is the larger, 15 to 30 cm. in lateral diameter when mature, with five acute ovate-lanceolate lobes well-defined by deep incisions. The sinuses are always well rounded at the bottom, never acute, though often narrow; the lobes mostly overlap each other and two lateral ones bear one or more minor lobes on their lower borders. The general outline is between reniform and cordate; the basal sinus is very narrow, the margins often overlap to some extent and occasionally unite for a short distance, thus making the leaf partially peltate.

In all cases a cup-like depression exists at the insertion of the leaf-blade. The petiole is 2.5 to 7.5cm. long, roundish, thick, swelling at the base and amplexicaul, with small tubercular stipules visible at an early age. The petiole and stem both diverge at their point of junction, giving the appearance of a bifurcate stem. The upper leaf is smaller, sessile at the junction of the peduncle of the flower with the stem, and partly clasping. The absence of the leaf-stalk in the smaller, combined with the angle of insertion of both blades, causes the leaves to occupy the same horizontal plane. The third leaf, when present, is much smaller, often distorted, always sessile on the peduncle, and possibly should be regarded as a bract. The flower is white, with a diameter of 12 to 18 mm., solitary, erect, terminal, on a peduncle 12 to 25 mm. long, with 3 or 4 orbicular, concave, green or purplish, caducous sepals, and no petals.

The stamens are 50 to 75, spreading, curving outward and upward, the pure white filaments gradually dilated from the base outward and somewhat contracted near the summit. The anthers are pale straw-color, adnate, with lateral longitudinal dehiscence. The 10 to 20 or more pistils are in a head, with white flat broadly two-lipped stigmas, the lips thin, rounded, and wavy-margined. The style is straw-colored, short and thick, being simply a contraction of the upper part of the ovary. The olive-green oval ovary is somewhat gibbous, sparingly pubescent, sulcate along the whole ventral aspect and the upper third of the dorsal, 1-celled and 2-ovuled. The red fruit resembles a raspberry and ripens in July or August. It consists of an aggregation of fleshy carpels, forming a globular head, each carpel bearing at summit the persistent style which is strongly inclines toward its dorsal aspect. The one or two seeds are small, about 2 by 3 mm. ovoid, black, hard and polished, anatropous, pendulous, with ventral rhaphe, fleshy albumen, and minute embryo.

GENERAL OBSERVATIONS.—The anomalous behavior of this plant in its first stage of growth has escaped observation, partly, I suppose, on account of its retiring habits. It always grows in patches in secluded and shady spots, where the earth is carpeted with decaying leaves; often beside rotting logs, where the roots are mulched by the decaying wood. The seed-leaves being small and often lying almost flat on the surface, would be observed only by chance; even then there would be nothing in their appearance to connect them with the plant under consideration, unless removed from the earth, when the root by its bright yellow color might indicate the relationship to Hydrastis.

In germination the cotyledons often arise from the earth separated by an interval of 2mm. or more and sometimes one cotyledon will show itself a day or so before the other one appears. If from any cause the cotyledons are destroyed early in summer the lemon-tinted bud does not grow until the following spring. Usually four different kinds of buds are found on an old plant, viz. large winter buds of two kinds, terminal and axillary; small latent buds, with scales but slightly developed; and adventitious buds that are formed on root fibers under certain conditions.

The winter buds of Hydrastis are large and deserving of special study, not only as illustrating the perfect protection that is so often provided for the tender parts during hibernation, but also as furnishing an excellent example in the morphology of leaves, the scales being homologous with stipules. The terminal bud is the largest, and developes the fruiting stem. The axillary bud produces a radical leaf; or, as often occurs, remains dormant for a time. The arrangement of the scales of a terminal bud at the close of the growing season, when the plant has fully completed the preparation for its period of rest, is such that but one, the outer, is truly equitant, the others, each in turn, completely overlapping and enfolding by their hooded and membranaceous expansions the inner till the young shoot itself is enshrouded by the last one.

On removing the scales at this period the young shoot is found to be large; the plicate foldings of the leaves are easily discovered, but the flower-bud is larger than all the rest, the stem being merely a conical eminence upon which the other parts sit. Yet the stipulate amplexicaul base of the petiole is visible, joined to the leaf, seemingly without the intervention of a leafstalk. The sessile leaf is very small indeed, entirely overshadowed by the comparatively enormous flower-bud whose sepals can easily be counted, and the stamens plainly observed.

Stipuliform appendages are not a feature of the order *Ranun-*

culaceæ, but Hydrastis has evident stipules, to be seen in the small tubercles, or points, projecting backward and upward from the amplexicaul petiole of the lower leaf of a fertile stem; and more plainly still at the base of the footstalk of a radical leaf, where they will be found, in early summer, incurved or overlapping each other and always enshrouded by the accompanying bud-scale. Later, when growth has ceased and the old bud-scales have decayed, there will be found, emerging from the overlapping stipules of a radical leaf, an abortive leaf on a short and rudimentary petiole, with a fully developed stipulate base, which enwraps another smaller one, and so on till the full complement necessary to the formation of a hibernaculum is present. Then, when the old radical leaf has served its time and is overtaken by decay there will be seen, for a short time, tipping the outer scales of the hibernaculum which sprung from its axil, instead of a mucronation, the depauperate leaf raised on a short and tapering footstalk but a few millimeters in height. Sometimes the depauperate leaf appears surmounting the inner scales of a terminal, or the outer scales of an axillary bud, as a digitate or merely fimbriate attachment without the intervention of a foot stalk. This soon perishes, and nothing will be found, after the bud-scale has expanded in the spring, but the blackened mucro, the remains of the footstalk of a depauperate radical leaf, thus plainly demonstrating that the winter bud-scales of Hydrastis are the homologues of stipules.

The development of a radical leaf without an offshoot, or caudex, from a bud in the axil of the lower bud-scale of a fertile stem of the same season's growth often occurs. The planes of insertion of the scales of a new bud are always at right-angles to the plane of the one from whose axil it sprung. Buds are formed in increasing numbers as each year passes, until as many as 20, or, even to 60 fertile stems may be found arising from one rhizome of from six to ten years age, together with a greatly varying number of sterile stems, or radical leaves, ranging from none at all in some cases, to perhaps twenty in others. Among almost every cluster from an old rootstock there will be found one or more stems bearing three leaves. After the annual decay of the stem there is left a cup-like depression at the summit of the caudex.

The persistence of these depressions, each for a few seasons, has given the plant one of its common names "golden seal." The rootstock is not horizontal, as represented in the drawings of all who have described the plant previously, and if ever found so it is an accident of growth, as I shall proceed to show. Development of rhizome begins with the second year, by the gradual thickening of the head of the primary fibrous root, or radicle. It is difficult to determine at this stage just where the rhizome ends and the root begins. The hibernacula are produced, after the second year, from short offshoots which spring from the axils of previous bud-scales, the offshoots being of such length only as to permit the bud to assume the erect position. The contortion or contraction produced in the rhizome by the decay of some of the offshoots each year is almost always in such manner as to cause the hibernacula to assume a more erect position, one in fact almost continuous with the older part of the rootstock. Thus a perpendicular axis is generally maintained. From this habit of growth an old rhizome is a knotty subdivided mass and presents no regularity of outline. The young rhizome, and the offshoots of the older ones, are marked by slight annular ridges, the sites of former bud-scales. It seems to be a law of development with this plant, that two or more years are required for the perfecting of a terminal bud and its supporting caudex. An old rootstock is abundantly supplied with fibrous roots. These, from their manner of growth and other characteristics, are found to be of two kinds, unequally apportioned. Those most numerous incline downward in their growth and have a length varying from 10 to 20 cm. the others are few in number, and larger, each measuring 20 to 50 cm. or more in length, with a diameter of 1 to 1.5 mm. and growing in a horizontal direction at a depth of 2.5 to 5 cm.

These large fibers under certain conditions sparingly produce adventitious buds, from each of which one or more small radical leaves arise on footstalks. These leaves are identical with the foliage of the second stage of growth from the seed. Three of these buds have been observed on a single large fiber at intervals of 7.5 cm. or more. They seemed to be formed only on those fibers that have been severed from the rootstock without greatly disturbing their distal extremities. Adventitious buds may occur upon the large fibers while yet attached to the rhizome, but if such is the case I have never yet observed it, the budding fiber always being found detached from the plant, with the proximal extremity blackened for a short distance by incipient decay. Young plants have not been observed to produce budding roots. The leaves have five lobes. Many books give seven, but all over five are as a rule minor lobes whose ribs spring, posteriorly, from the two inferior basal veins. The veins are very prominent on the lower surface and there is a considerable linear depression on the upper surface, in their track. This gives the leaf at the time of flowering, when it is but slightly developed, a very rugose appearance, which persists for some time. The plant puts forth very early, and before the forest is fully clothed in leaves it has attained almost its full development in all points save the expansion and ripening of the fruit, and the maturing of its underground structures. This energy for the first few days is mostly expended in the growth of the stem, which arches over and bends itself as it is extended from the caudex, bursting asunder the bud-scales, which have begun to enlarge rapidly, the inner one especially developing beyond the others. The stem, thus bent, emerges from the earth often 5 cm. or more before the top is dragged forth. Sometimes it happens, when the ground is hard and dry, that it fails to extricate itself, and therefore perishes. The leaves are but slightly developed when the flower appears, which occurs almost immediately after the stem assumes the erect position. The flower lasts five or six days. In a dry season the plant dies down soon after the ripening of the fruit, and by late September the top has disappeared. Again when the season is more moist it will persist even to the beginning of winter.

The fruit when ripe is readily detached from the stem, and has a shallow depression at its base. It is insipid to the taste, non-poisonous, and is eaten by birds, by which means the seeds are disseminated. From various causes but few of the seeds naturally sown ever germinate, and the extension by adventitious buds forming on the root fibers is very slow, as this mode of propagation does not seem to be as well established with this plant as it is with some others.

It would seem from present indications, that the time when Hydrastis will be no longer found in our forests is almost at hand. Possibly its total extinction could never have occurred from the settling and clearing up of the country only, since the natural terraces of many inaccessible ravines, bluffs and mountain sides, where the material best suited for its sustenance had accumulated for centuries, would have been its impregnable strongholds. But the drafts made upon it in pharmacy to supply the growing demand of the medical profession have set upon it that impecunious class, the "sang" and "puccoon" diggers, who have almost exterminated it in many of those regions where it grew in great abundance.

It may yet be found from the Mississippi river to the Alleghenies, as far north as Canada and to Tennessee on the south, with a limited area of distribution beyond the Mississippi, in Missouri and Arkansas[1]. Over most of this territory it is now so thinned out that its collection is not the commercial success it formerly was. The above boundaries very nearly mark the extent of the distribution it had attained on the earth's surface in its most flourishing time.

But, in this region of central Indiana, within the area of its former natural abundance, I have demonstrated by experiments of some years' duration, that it can be successfully grown by giving it as far as possible the surroundings that it had in the pioneer days of the country. It endures close association with but few other herbs, yet the shade afforded by many of the shrubs and forest trees, if not too dense, seems to be a requirement essential to its perfect growth and development. The grasses are its deadly enemies, and ground that is trodden will not support it. Under such conditions it quickly perishes. A single large plant, removed from the woods to a suitable situation, I have observed in several instances to spread so that an area of five or six feet in diameter would be occupied in eight or ten years time, without any artificial aid, save the keeping in subjection of all other encroaching plants.

Individual characteristics are noted, as marking with more or less variation each group or patch of plants, indicating, that though Hydrastis is a recluse among plants, and presents some deviations that are remarkable, yet this one feature which it possesses in common with most representatives of the vegetable kingdom, may lead through judicious selection and the careful study of its habits of growth, to the establishment, in time, of new varieties. This possibility the following observations of three district patches, originating from plants obtained from different points, and grown on my grounds, seem to show:

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[1] Lloyd's Drugs and Medicines of North America, vol. 1, no. 3, pl. IX.

Patch no. 1, short: stems 15 to 20 cm.: peduncle short, 6 to 12 mm.: fruit almost sessile on some; carpels 12 to 18: leaves rugose, much incised resulting in many minor lobes, though but five basal veins: color of stems mostly green, slightly purple at base.

Patch no. 2, medium: stems 25 to 30 cm., purplish from base $\frac{1}{3}$ of height: peduncles 18 to 25 mm.: carpels few: leaves coarsely serrate, minor lobes rare, scarcely pubescent, large, many of them 30 cm. across.

Patch no. 3, tall: stems 30 to 37.5 cm. purplish from base $\frac{2}{3}$ of height: peduncles 35 mm.: carpels 25 to 30: leaves slightly rugose, lateral diameter of lower leaves 25 to 30 cm., minutely pubescent.

New Ross, Indiana.

Explanation of Plate VIII.—Fig. 1, seedling 2 or 3 days after germination. Fig. 2, seedling at the end of the first season's growth. Fig. 3, second year from the seed. Fig. 4, *a*, top of flowering plant early in May, stipular eminences plainly shown at base of lower leaf; *b*, flower with most of the stamens removed. Fig. 5, part of stem with fruit, late in July. Fig. 6, stipules; *a*, part of fertile stem with amplexicaul petiole of lower leaf, showing tubercular stipules; *b*, caudex with portion of radical leaf petiole, old bud-scales dissected back and showing stipules at base enveloping the rudimentary hibernaculum, depauperate leaf protruding, as observed in June. Fig. 7, stipules as bud-scales; *a*, bud-scales at base of fertile stem, early in May; *b* and *c*, buds formed in the axil of a radical leaf, as they appear in October or November, with outer scales dissected back; *b*, one of the bud-scales surmounted by a depauperate leaf; *c*, same with merely fimbriate attachment; Fig 8, horizontal root fiber, with adventitious bud and radical leaf. Fig. 9, rhizome with most of the fibrous roots removed, showing perpendicular character of axis. Fig. 10, series showing transition from floral bract to leaf, as sometimes observed in exceptional cases where third leaves are produced; *a*, part of upper portion of stem showing attachment of sessile leaf, floral bract, and fruit soon after anthesis; *b* and *c*, same with bracts more leaf-like.

Two undescribed species of Apodanthes.

B. L. ROBINSON.

(WITH PLATE IX.)

It is now more than twenty-five years since the discovery, in western Arizona, of *Pilostyles Thurberi* Gray, a diminutive parasite which, notwithstanding great disparity in size, is nearly related to the famous Rafflesia of India. Although the genus Pilostyles, or more correctly, Apodanthes § Pilostyles, is well represented in South America, the rare A. Thurberi has until lately been its only known North American species. Among the many discoveries made by Mr. C. G. Pringle, however, two new members from northern Mexico have been added to the genus; and specimens of these interesting plants (nos. 1949, and 1950 of Pringle's *Plantae Mexicanae*) have recently been distributed as *Apodanthes Pringlei* Watson, and *A. globosa* Watson. Owing to the diminutive size of the plants in question, their study entailed methods not generally necessary in the systematic examination of phanerogams, and the publication of descriptions of the new species has been much delayed. At the suggestion of Dr. Watson, however, the writer has lately made a microscopic examination of the material in the Gray Herbarium, and presents, as a result, the following descriptions, which are as full as the limited stages of development represented permit.

Apodanthes Pringlei Watson.— Flowers densely crowded cylindric, becoming ovoid, one and one-half lines long, aromatic; bracts and divisions of the floral envelope twelve to fifteen, erect, very unequal in length, imbricated in three (or four) obscurely defined series, ovate to oblong, obtuse, entire or minutely erose, dull brown, the innermost yellowish at the ends: ovary inferior or nearly so, usually quadrangular in cross-section, and with four distinct though rather broad placentæ; style well developed, fully half as long as the ovary; stigma ovoid, umbonate on the slightly produced non-stigmatic apex; fruit broadly ovoid, two lines long, one and one-half lines in diameter, covered with the closely appressed bracts: staminate flowers unknown.—Occurs upon small woody branches of *Dalea frutescens* Gray; collected by C. G. Pringle in the Sierra Madre near Monterey, June 27, 1888.

The placentation of this species shows more or less variability, not only in different flowers, but even at different heights in the same ovary. In most cases a cross-section directed through the middle of the ovary shows (as in fig. 4) the placentæ in a regular relation to the surrounding bracts. In other instances, however, no such correspondence is apparent, and the placentæ are not even symmetrical in relation to each other.

Apodanthes globosa Watson.— Expanded flowers and fruit unknown: buds scattered, globose, two-thirds to one line in diameter; bracts and divisions of the floral envelope eleven to thirteen, subequal, in three distinct decussate series, broadly ovate to orbicular, minutely erose, thickish, transversely roughened on the outer surface, very dark and shining purple: in the staminate flowers the anthers about thirty, globose, sessile, borne in two crowded rows upon the shaft of the staminal column, of which the upper expanded portion is convex, and minutely papillose over its entire surface, the papillae upon the edges being slightly more prominent; a rudimentary ovary (?) is represented by a narrow central cavity in the base of the column: in the pistillate flowers ovary inferior, three to four angled, but with no regular placentæ, the ovules being distributed in small isolated groups over the entire inner surface; style scarcely any, the stigma large, hemispherical, umbonate.—Occurs on small branches of *Bauhinia lunarioides* Gray; collected by C. G. Pringle in the Sierra Madre near Monterey, June 30, 1888.

This species considerably resembles in size and form *A. Blanchetii* Gard. of Brazil, also parasitic on a Bauhinia. In the latter, however, the bracts are described as fimbriate-ciliate on the margins, while in A. globosa they are at most minutely erose. Furthermore the ovules of A. Blanchetii, according to Sir Joseph Hooker,[1] are crowded over the whole surface of the ovary, while in A. globosa they occur in rather small isolated groups. The single staminate flower of A. globosa, which was found in the material investigated, occurred upon the same branch with many pistillate flowers. Although a considerable number of flowers of A. Pringlei were examined, all proved to be fertile. The "thallus" of A. Pringlei, investigated by cutting sections of the infested branches of Dalea, appears at the time of flowering to consist of dense, isolated, more or less wedge-formed masses of tissue, extending not only through the cortex but to a considerable depth along the medullary rays into the woody tissue of the host.

Cambridge, Mass., Nov., 1890.

EXPLANATION OF PLATE IX.—*Apodanthes Pringlei* Watson.—Fig. 2 represents the habit of the parasite as it occurs upon the host plant; fig. 1, flowers; fig. 3, fruit; fig. 4, cross-section of the flower, showing the usual placentation; fig. 5, median longitudinal section of the flower; fig. 6, ovule. All the drawings except fig. 2 are considerably magnified.

Apodanthes globosa Watson.—Fig. 7, longitudinal section of a staminate flower; fig. 8, the same of a pistillate flower; figs. 9 and 10, successive (rather thick) cross-sections, showing the varying placentation at different heights in the ovary. This may also be clearly seen in the longitudinal section, fig. 8.

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[1] In De Candolle's *Prodromus*, vol. xvii, p. 115.

BRIEFER ARTICLES.

Erythræa Pringleana Wittr. nov. spec.— Planta annua, subparva, 8–21 cm. alta, paullulum ramosa, glabra; foliis omnibus brevioribus quam internodiis; foliis infimis non rosulatis, ovatis apice acutato, brevissime pedunculatis, minimis, 2–3 mm. longis; foliis inferioribus lanceolatis, 3–6 mm. longis; foliis mediis et superioribus lineari-subulatis, 6–15 mm. longis; floribus longe pedunculatis, pedunculis plerumque longioribus quam floribus; sepalis eadem fere longitudine vel paullo longioribus quam tubo corollæ; hoc tertia fere parte breviore quam laciniis limbi; his 7–10 mm. (plerumque 8 mm.) longis, ovatis apice paullulum crenulato; corolla emarcida laciniis limbi contortis persistente, fructus includente; antheris staminum brevioribus quam filamentis; germine eadem fere longitudine vel paullulo longiore quam stylo stigmateque.

Mexico: in collibus prope Guadalajara $18\frac{5}{12}88$ legit cl. *C. G. Pringle*, (no. 2595).

Haud impossibile mihi videtur hanc speciem cum *Erythræa tenuifolia* Martens et Galeotti, anno 1844, ad exemplaria prope Guadalajara lecta, manco in modo descripta, identicam esse. Nomen specificum "tenuifolia" tamen secundum legem prioritatis non est retinendum, quia cl. *Grisebach* Erythræam alteram (e Hungaria et Gallia) jam anno 1839 sub hoc nomine descripsit.— Veit Wittrock, *Stockholmia* mense Januarii 1891.

[It may be well enough to state in this connection that what was distributed as "*Microcala* n. sp." (no. 2598) is *Schultesia Mexicana* Watson, n. sp., soon to be published.—C. G. Pringle.]

New species of Montana fungi (with plate X).— The illustrations of two new species of Montana fungi described last month, p. 47, were received after the number was in press. At the authors' request they are now published with the accompanying

Explanation of Plate X.—*Sporidesmium sorisporioides* Ellis & Anders. 8, fungus about natural size on dead wood of Populus tremuloides; 9, small mass of spores superimposed on the hyaline, semiamorphous mycelium, from the swelling up and internal division of the elongate ends of which the spore-masses are developed; 10, two mature spore-masses, *A* having become quite free from the mycelium.

Aecidium Liatridis Ellis & Anders. 11, portion of leaf of Liatris punctata about natural size showing a patch of the fungus; 12, a small patch considerably magnified; 13, a perfect tube (cup) more highly magnified. At *A* is shown a cup that has gradually broken down to almost the surface of leaf; 14, four spores; 15, several cells of host

tissue showing the mycelial threads of the aecidium which permeate the leaf tissue in all parts of the affected spots; 16, a few of the pseudoperidial cells highly magnified to show their true shape.

EDITORIAL.

ONE OF THE hard questions that working botanists are called upon to answer, especially those who are also concerned in training botanists, is "what original work shall I do?" The background of the question usually contains no literature and no appliances other than a few standard botanical works and a microscope. There seems to be a widespread notion that when one comes into the possession of a compound microscope he is equipped for "original work." The lack of literature and collections precludes the recommendation of any systematic work. The general lack of knowledge as to the ease with which certain important physiological phenomena can be observed, usually excludes any such answer to the question. Besides, the applicant for "original work" expects that it will involve doing something with his microscope. Nine times out of ten the advice will be given to study the minute anatomy of some plant, as the easiest thing to do. Naturally this is the expected advice, and sectioning and drawing begin at once. But the proper study of the minute anatomy of any plant is far from being "the easiest thing to do," and to recommend any such study to one who has not been thoroughly trained by a competent instructor, is to make a great blunder.

IN THE first place, the ability to correctly interpret is not in the possession of any tyro who can cut a section or focus a microscope. There are more optical illusions due to the microscope than to anything else, and it is chiefly these illusions that will be drawn and reported when difficult, and hence interesting, structures are being investigated by an untrained observer. The unrecognized hiatuses in what appears in the field of the microscope may be small enough when measured by the metric system, but they may be of infinite importance in the interpretation of structures. Such work can only be done by the most careful and reiterated labor of a trained observer. Of course all this only applies to cases where publication is contemplated, for any amount of valuable information may be obtained in a very pleasant way by any one who is doing such work merely for his own edification. But when work rises to the dignity of being called "original investigation," it is proper that it be hedged about by a full knowledge of its real difficulties.

IN THE second place, the claim that no library is needed for such work, and that all that one needs is a microscope, is a mischievously false notion. It is far easier to-day to command a literature that will enable one to do some systematic work upon the flora of North America, than one which will enable an anatomist to properly discuss an anatomical subject. The absence of references to literature (and by this is not meant foot-note references) in such investigation leaves the work "in the air." It is like shooting with a shotgun in the general direction of the game in the hope of hitting something. If the investigator is not prepared to say what he has found that is new, no one else is apt to take the trouble to do it for him. The sooner we can get rid of the notion that a microscope is a magic instrument, which when touched transforms one into an original investigator, the better. It is just as magical as a hand-saw, of which tool one may possess a chest-full, and yet not be a carpenter.

CURRENT LITERATURE.

The grasses of dry climates.[1]

The author of this paper calls attention to some hitherto unknown peculiarities in the grasses of dry climates, among them being the singular development of the lowest internodes of the culms, shoots and basal leaves. He considers these characters just as important as the interior structure of the leaves for adaptation to a dry climate. He distinguishes: 1. tuberous and bulbous grasses; and 2. tunic-grasses. Tuberous grasses are such as *Phleum pratense* var. *nodosum* Gaud. and *Arrhenatherum avenaceum* var. *nodosum* (*Avena nodosa* L.), of which one or more of the basal internodes of the culm and shoots attain a tuberous development, while *Poa bulbosa* L. represents a bulbous grass, since here the bases of some of the sheaths of the leaves have increased in thickness and form a bulb very much like that of an Allium. The tuberous grasses are relatively rare in comparison with those whose culms are not thickened, a circumstance which has led to their being ranked as mere varieties. Such forms are especially prevalent in the Mediterranean countries. The same is also the case with Poa bulbosa, which occurs more commonly in these countries than further north. Besides the above mentioned, are the tuberous

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[1] E. HACKEL.—Ueber einige Eigenthuemlichkeiten der Græser trockener Klimate.—Verhandlungen der k. k. zool.-botan. Gesellsch. Wien, Jahrgang 1890, pp. 125–138.

Alopecurus bulbosus L. and the bulbous *Festuca spadicea* L., the only ones of this group which occur in Middle-Europe.

The author, has, however, observed similar forms to be abundant and more characteristic of other parts of the world. Those he enumerates from our own country are as follows: From California and the Western States the tuberous *Melica bulbosa* Gey., *Californica* Scribn., *spectabilis* Scribn., *fugax* Bol., *bromoides* Gray and *subulata* Scribn., *Beckmannia eruciformis* Host. and finally from Mexico the tuberous *Panicum bulbosum* Kth., *scaberrimum* Lag. and *Torreyi* Tourn.

These tuberous and bulbous forms only occur in countries with periodical dry seasons, and none have been observed in the moist parts of the tropical region. It is very interesting to learn that the author does not consider these tubers or bulbs as reservoirs of starch or sugar, as are the similar organs of Liliaceæ, Iridaceæ, etc. Though they are structurally homologous with these, physiologically they are water-reservoirs. The author has shown that Poa bulbosa on being cultivated in moist soil almost lost its bulbous character.

The second group, *Gramina tunicata*, includes forms in which the base of the culms and shoots are covered with at least three faded sheaths. These all inhabit dry localities. In those forms which prefer damp or shaded places, there is usually but one faded sheath present, and even that disappears very soon. The typical tunic-grasses are especially characteristic of the Mediterranean region, and besides the tuberous and bulbous forms, all the other perennial Mediterranean species belong undoubtedly to this group. The author distinguishes between straw- and fiber-tunics; in the former the sheaths remain complete, although faded, in the latter the sheaths break up into fibers. Of these two groups the fiber-tunics are characteristic of the Mediterranean region, while the straw-tunics occur in all the other countries with similar climate. Some forms from Australia, Capland, India, Brazil and North America show the development of wool or felt on the sheaths, as for instance *Eragrostis eriopoda*, *Danthonia lanata*, *Bouteloua eriopoda* and others, representing wool- and felt-tunics. The function of these different tunic structures is undoubtedly to serve as reservoirs of water, as has been proved experimentally in the case of Koeleria setacea and a variety of Andropogon contortus. The author of this interesting paper calls the attention of botanists for further studies upon this subject.—THEO. HOLM.

Minor Notices.

MR. A. S. HITCHCOCK, of the Shaw School of Botany, has just published a catalogue of the vascular plants in the vicinity of Ames, Iowa. It is no. 7 of the contributions from the Shaw School. The list is based upon collections made during the years 1882 to 1889, and shows very careful work. Specialists have been consulted in their various groups, and the nomenclature follows the use of the oldest specific name in every case, accompanied by many useful citations of authorities.

THE LAST number of *Pittonia* is before us (vol. ii, part 9) and we note the following contents: In a discussion of the genus Actæa, Prof. Greene doubts whether we have the true Old World A. spicata with us at all, and is also confident that we have 3 or 4 species of our own. He characterizes a new species from Arizona. Ranunculus ellipticus is a new species to replace much that has been called R. glaberrimus. A very useful feature of this number is the reprint of the old Fraser's Catalogue, really written by Nuttall, often referred to, and very inaccessible. American botanists will thank Professor Greene for this valuable addition to their reference libraries. A prominent contribution is that concerning some genera of Rafinesque. It would be a wonderful relief if botanists could be certain once for all just what genera Rafinesque is entitled to. Some 14 or so are recognized in Gray's Manual, and Professor Greene thinks the number will eventually be almost doubled. He presents the following results of his bibliographical investigations: *Shepherdia* Nutt.= *Lepargyræa* Raf.; *Maclura* Nutt.= *Ioxylon* Raf.; *Downingia* Torr.= *Bolelia* Raf.; *Echinocystis* T. & G. and *Megarrihiza* Wats.= *Micrampelis* Raf.; *Stephanomeria* Nutt.= *Ptiloria* Raf. Of course these conclusions are accompanied by a presentation and naming of all the species. The North American species of the genus *Lotus* (= *Hosackia*) are presented, to the number of 54. The part closes with a revision of the genus *Diplacus* Nutt., a genus including a few species usually referred to *Mimulus*.

MR. THEODOR HOLM, of the U. S. National Museum, has long been studying the underground structures of plants, a very much neglected study. In a paper (reprinted from the January number of the *Bull. Torr. Bot. Club*, pp. 1–11) he contributes some very interesting information concerning Uvularia, Oakesia, Dicentra and Krigia. The descriptions are elucidated by three excellent plates.

OPEN LETTERS.

Last words on "biology."

I had thought that botanists were a gentle folk, but in the late numbers of the GAZETTE I have been treated in the same manner as they treat their plants — pulled to pieces. One accuses me of missing the whole point in question, while the other charges me with all the sins in the philological and metaphysical decalogues.

I have received no little information (or misinformation) from these two articles, but the point I made has been ignored.

The question in my mind resolves itself merely into this. Can a man teach biology without teaching the whole of the subject? Can he teach mathematics, unless he teach both arithmetic and quaternions? Can he teach modern languages unless he teach the whole 961 tongues? I claim that he can, and, words aside, this was the whole contention of my previous letter.

If a college or university is in position to give a well rounded biological education it is certainly its duty to do so, and I, as heartily as any one else, can find fault for short-comings in this respect. But if the institution be limited neither botanist nor zoologist should find fault because the biological training has a distinct trend towards either animals or plants, so long as it has a distinctly *biological* character, and it will have such a character if it regards its materials as a part of the living world. For the comfort of my critics I may add that the reason why the majority of such biological chairs are filled with animal biologists is because such have had on the whole the better training.— * * *

Pocket edition of Gray's Manual.

An announcement just made by the American Book Company, publishers of Gray's botanies, possesses unusual interest for botanists. It is of a special edition of the Manual "in small and compact form for satchel use." This is to be printed on thin French paper with narrow margins, so as to make it small and thin. It will be bound in full leather, limp, and cut flush, very much like a foreign guide book. The binding is to be on parchment strips such as are used in the best English prayer books, and the book is intended to stand rough usage. To many it will be a matter of sincere congratulation, that we are to have the indispensable "Manual" in field form. Its issue may be looked to with interest, since it is to be sold at the moderate price of two dollars.— AUG. D. SELBY, *Columbus, Ohio.*

NOTES AND NEWS.

DR. C. F. MILLSPAUGH, in *Zoe* (Jan.), describes two new Euphorbias from Lower California.

THE *Annals of Botany* proposes hereafter to give considerable prominence to systematic botany.

IT IS REPORTED that Pachystima Canbyi is in successful cultivation in the public gardens of Münden, Germany.

MR. F. W. ANDERSON is drawing the 60 plates to illustrate Mrs. E. G. Britton's Handbook of Mosses of N. E. America, which is in preparation.

MR. HEMSLEY's place in the Kew Herbarium, left vacant by his promotion, has been filled by the appointment of Dr. Otto Stapf, of Vienna.

A CONVENIENT KEY to the genera and species of British mosses is published (with a plate) by Rev. H. G. Jameson in the last *Journal of Botany* (Feb.).

MR. F. H. KNOWLTON, of the U. S. Geol. Survey, has published an account of fossil woods and lignites from Arkansas. Two new conifers (Cupressinoxylon) and two new dicotyls (Laurinoxylon) are described and figured.

IN THE *Philadelphia Public Ledger* of Jan. 20, Mr. Thomas Meehan publishes an interesting account of an almost forgotten botanist, Mathias Kin, a man well know to Muhlenberg and Collins, and about whom Dr. Asa Gray wrote that his history should be worked up by Philadelphia botanists.

IN AN INAUGURAL dissertation at Erlangen, Georg Schneider shows that the "wax" of Myrica cerifera is more nearly allied to the fats than to the wax-like bodies. It consists chiefly of palmatin (70 per cent.) myristin (8 per cent.) and lauric acid (4.7 per cent., mostly free), to form which 9.4 per cent. of glycerin is combined with the corresponding fatty acids.

SOME ACCOUNT of the occurrence and life history of the clover rust (*Uromyces Trifolii* Wint.) has been published by Miss J. K. Howell, (Bull. Cornell Exper. Station, No. 24). The uredo stage was produced upon both red and white clover plants by artificial sowing of the æcidiospores. Attempts to germinate the teleutospores in the spring unexpectedly proved quite fruitless.

DR. JOSEPH BOEHM has at least the merit of consistency in the framing of his theory of transpiring plants. It follows, he says to the Royal Botanical Society of Vienna,[1] since capillarity is the cause of the absorption and ascent of water in transpiring plants, that under certain conditions the transpiration stream may be reversed, so that water must escape from the plant into the ground!

IN THE last *Bulletin of the Torrey Botanical Club* (Feb.) Dr. Morong gives an interesting account of the flora of the desert of Atacama. In the same number Dr. Britton describes six new plants from Dr. Rusby's S. American collection, belonging to the following genera: Begonia, Hariota, Hydrocotyle, Arracacia, Sciadophyllum, and Oreopanax; and Mrs. Britton describes and figures two new Idaho mosses, a Grimmia and a Bryum.

THE PRODUCT of marketable shoots of asparagus is found by W. J. Green (Bull. Ohio Exper. Station, iii, p. 241) to be fifty per cent greater from male plants than from female plants. Preliminary tests were made in 1889, and more complete tests in 1890. During the latter year 50 plants of each kind were used. The difference in vigor is ascribed to the exhaustive effect of seed bearing in the female plants, which is absent in the male plants.

PROF. DR. F. B. POWER and Mr. J. Cambier have recently examined chemically two of the best known "loco-weeds," Astragalus mollissimus and Crotalaria sagittalis. They close their paper in *Pharm. Rund-*

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[1] Bot. Centralb. xliv, 355.

schau (Jan.) by saying: "These results have afforded us the conviction that both the Astragalus and the Crotalaria contain very small amounts of toxic alkaloids, to which we believe the symptoms of poisoning produced by these plants may reasonably be attributed.

IT IS WELL established that the ovules of the higher plants are homologous with the sporangia of vascular cryptogams. The sporangia in the latter are produced on leaf-structures—the sporophylls. In the Angiosperms the question of their origin is unsettled. Gœbel investigated a considerable number of doubtful cases. His results are confirmed and extended by Schaefer[1] who finds that in all cases the placenta develops as a part of the carpel and not in the axil of the carpel.

MR. CHARLES ROBERTSON has continued his interesting series of observations on flowers and insects by publishing the *Umbelliferæ* in *Trans. St. Louis Acad. Sci.* (vol. v, no. 3). The group is so uniform in flower-structure, and the species bloom so continuously through the growing season, that they are specially favorable for investigation concerning the effect of time of blooming on the character of the visitors. In his general review of the order Mr. Robertson draws some very interesting conclusions, which are too numerous and specific to be enumerated here.

THE REPORT of the botanist of the Department of Agriculture for 1890 will show that the following collectors have been at work during the year in unexplored or interesting regions: Dr. Edward Palmer in Lower California, Western Mexico, and Arizona; Mr. G. C. Nealley in Western Texas; Mr. J. H. Simpson in the region about Manatee, Florida; and Mr. C. R. Orcutt in the Colorado Desert of Southern California. All these collections either have been or will be reported upon in the new series of "Contributions" now being issued by the National Herbarium.

IN THE *Amer. Chem. Jour.* (xiii, 1) Dr. H. W. Wiley gives an account of "pine-tree honey-dew" and "pine-tree honey." His conclusion is that the "honey-like exudation of the pine tree differs in a marked degree from the honeys of ordinary plants in being right-handed, from a polariscopic point of view, and containing bodies not sucrose nor invert sugar, with a specific rotatory power of about 105. Honey made from this pine-exudation is naturally right-handed, a character as yet observed to be possessed by no genuine honey collected in this country."

HERETOFORE no cells have been recognized in the vascular bundles of the Gymnosperms, which were either the anatomical or physiological representatives of the "companion-cells" of the sieve-tubes. Strasburger, however, now considers the parenchyma cells, rich in protoplasm, which surround the sieve-tubes or are distributed between them as the physiological equivalents of the companion cells. These cells stand in intimate physiological and anatomical relations with the sieve tissue, by means of pits.—Cf. Sitz. d. königl. Preuss. Akad. d. Wiss. zu Berlin. 1890. xiii.—Abstr. in Bot. Cent. xliv. 192.

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[1] Flora, 1890, heft 1, *fide* Bot. Cent. xliv, 368.

F. LUDWIG finds in the Synchytrium-galls on Anemone nemorosa a red coloring matter, readily soluble in water, whose identity with anthocyanin he has established. It is a derivative of tannin. He raises the question as to its significance—whether it is a purely pathological product, or whether it serves as a protection to the fungus against snails. He points out the general red coloration and abundance of tannin in insect galls and reminds his readers of Stahl's researches which show the avoidance of tannin-bearing plants by snails. —Cf. Verh. bot. Ver. d. Prov. Brand. xxxi. p. vii, and Bot. Cent. xliv. 82.

THREE NEW methods of preparing aleurone grains of Ricinus are as follows: 1. The Overton method.[1] After hardening sections for several hours in absolute alcohol, immerse them in an aqueous solution of gallotannic acid. The crystalloids absorb the acid and become brownish on treatment with 1 per cent. osmic acid. After washing in distilled water place in glycerine. 2. Poulsen's methods.[2] (*a*) Harden in absolute alcohol 24 hours; place for an hour in a 25 per cent. aqueous solution of tannic acid; wash in distilled water; place in an aqueous solution of bichromate of potassium and allow to remain until brown. Wash and preserve in glycerine. (*b*) Treat as in (*a*) but use a 10–20 per cent. aqueous solution of sulphate of iron (which results in a deep blue coloration), wash, dehydrate, clear with clove oil and mount in balsam.

PFEFFER criticizes the conclusions of Hugo de Vries and his pupils as to the origin of vacuoles and the plasma membranes of the cell. (For these views see notes in this journal, xiv. 24, 137.) Pfeffer however affirms[3] that he has been able to produce vacuoles artificially in the plasmodium of Chondrioderma difforme by causing it to enclose solid particles of various soluble substances. The artificial vacuoles were in no wise distinguishable from the true. He also observed the division and fusion of these vacuoles, as well as their fusion with a pulsating vacuole. In some cases they even showed a slight pulsation themselves. His criticisms on the existence, origin and significance of the membrane surrounding the plasma and the membrane enclosing the vacuole are equally radical. A clear insight into these structures seems not yet reached.

THE PRESS, a daily paper of Christchurch, New Zealand, bearing date of Jan. 16, has just been received, giving account of the opening sessions of the other A. A. A. S., the Australasian Association for the Advancement of Science. The sessions began January 15, at Christchurch, in Canterbury College, with the distinguished botanist Baron von Mueller in the chair as retiring president. The proceedings are reported in full, and the whole affair seems full of an energy and spirit which augur well for the future of the younger A. A. A. S. It will be remembered that at the Indianapolis meeting of the American Association the retiring President, Dr. Geo. L. Goodale, was appointed as representative to the Australasian Association. The New Zealand paper gives an account of his cordial reception by the association, and his address in reply. An interview with Prof. Goodale is also printed, in which he gives the Australasians much information concerning science in America, the American Association, and Harvard University. Prof. Goodale is travelling chiefly in the interests of the new Botanical Museum at Cambridge, and will return home by way of Java, China, and Japan.

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[1] Cf. Bot. Cent. xliv, 1 (1890). [2] Rev. gen. de Botanique, ii, 547.
[3] Abhand. d. Math.-Phys. Class. d. Sachs. Gesells. d. Wiss. xvi, p. 185—345. —Abstr. in Bot. Cent. xliv. 180.

THE PHYSIOLOGICAL significance of calcic oxalate according to Dr. G. F. Kohl[1] lies in the fact that the oxalic acid and its congeners are by-products in the synthesis of proteids from amides and carbohydrates. If this is true oxalic acid and its salts ought to occur in all plants. While however calcic oxalate in the higher plants is very wide-spread, in the thallophytes it is strikingly rare. Kohl shows that nevertheless oxalic acid is abundantly produced by both fungi and algæ, and that it will readily combine with calcium when under proper conidtions. The production of oxalic acid by the recently described Saccharomyces Hansenii has been designated as oxalic acid fermentation which is reckoned as one of the oxidative fermentations, in contrast to the splitting fermentations. Fermentation is in all cases, he says, nothing but a nutritive process of the ferment-inducing organism, with its consequences. Colorless organisms must decompose—*ferment*—carbohydrates, alcohols, etc., obtained from without; color-bearing and therefore mostly CO_2-assimilating organisms on the contrary decompose—*ferment*—self-formed carbohydrates, etc. Logically we must say: *all plants are fermenting agents;* for if we call the formation of oxalic acid by a fungus "oxalic-acid fermentation" we must extend this designation to all plants in which the formation of oxalic acid occurs. We can arrange plants in two series according to the main product of the fermentation, the first including those which induce oxidative fermentations, the second including the agents of splitting fermentations.

Plants.	*Oxidative fermentation.*	*Splitting fermentation.*
Schizomycetes	acetic acid	Alcohol, lactic acid, butyric acid.
Numerous other fungi	oxalic acid carbonic acid	Alcohol.
Algæ	oxalic acid carbonic acid	———
Bryophytes, Pteridophytes, Phanerogams.	carbonic acid oxalic acid tartaric acid malic acid	———

The lower plants thus induce chiefly splitting fermentations, the higher exclusively oxidative.

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[1] Bot. Centralb. xliv. 337.

5
7 b
b
4
a
4
2
7 c.
7 a
10 a
b
10
c
10
1
6 a
9
3.
8
b
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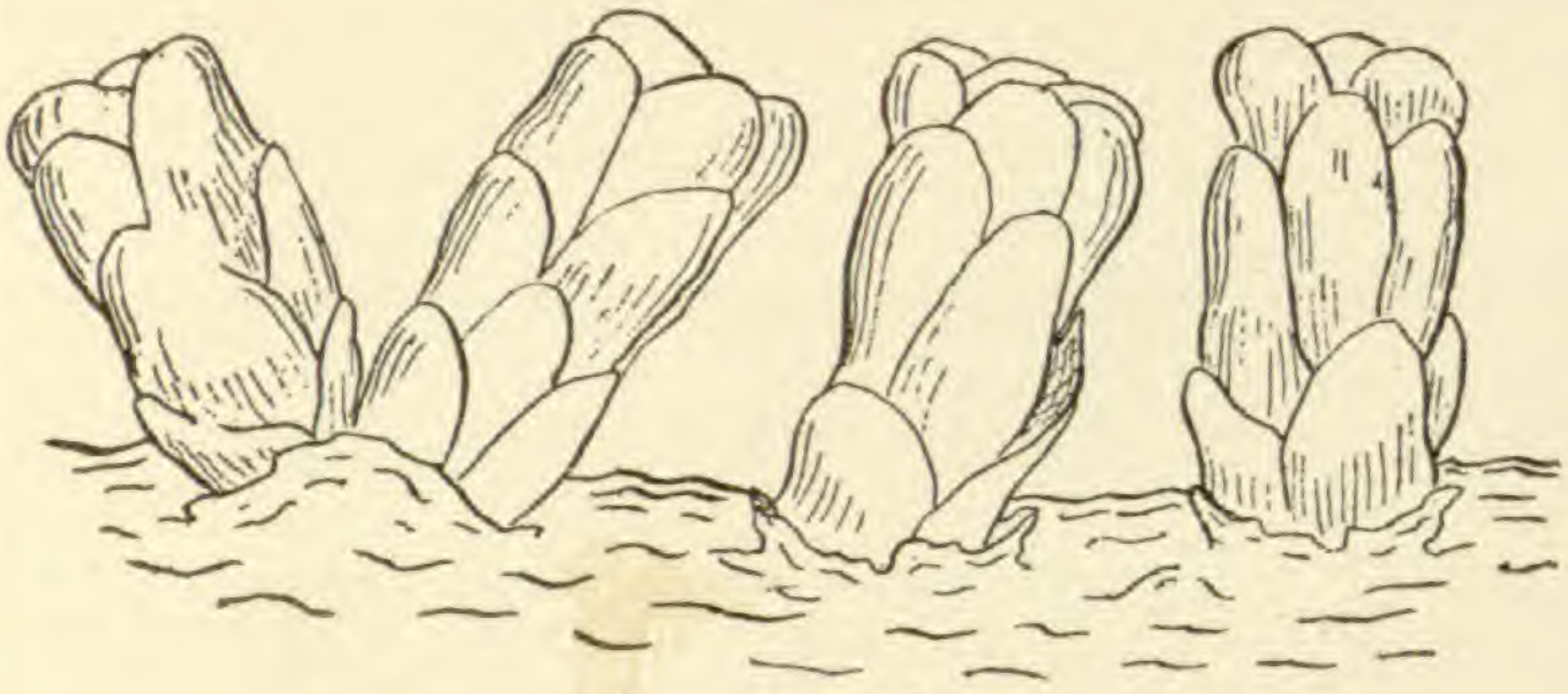
BOWERS on HYDRASTIS.



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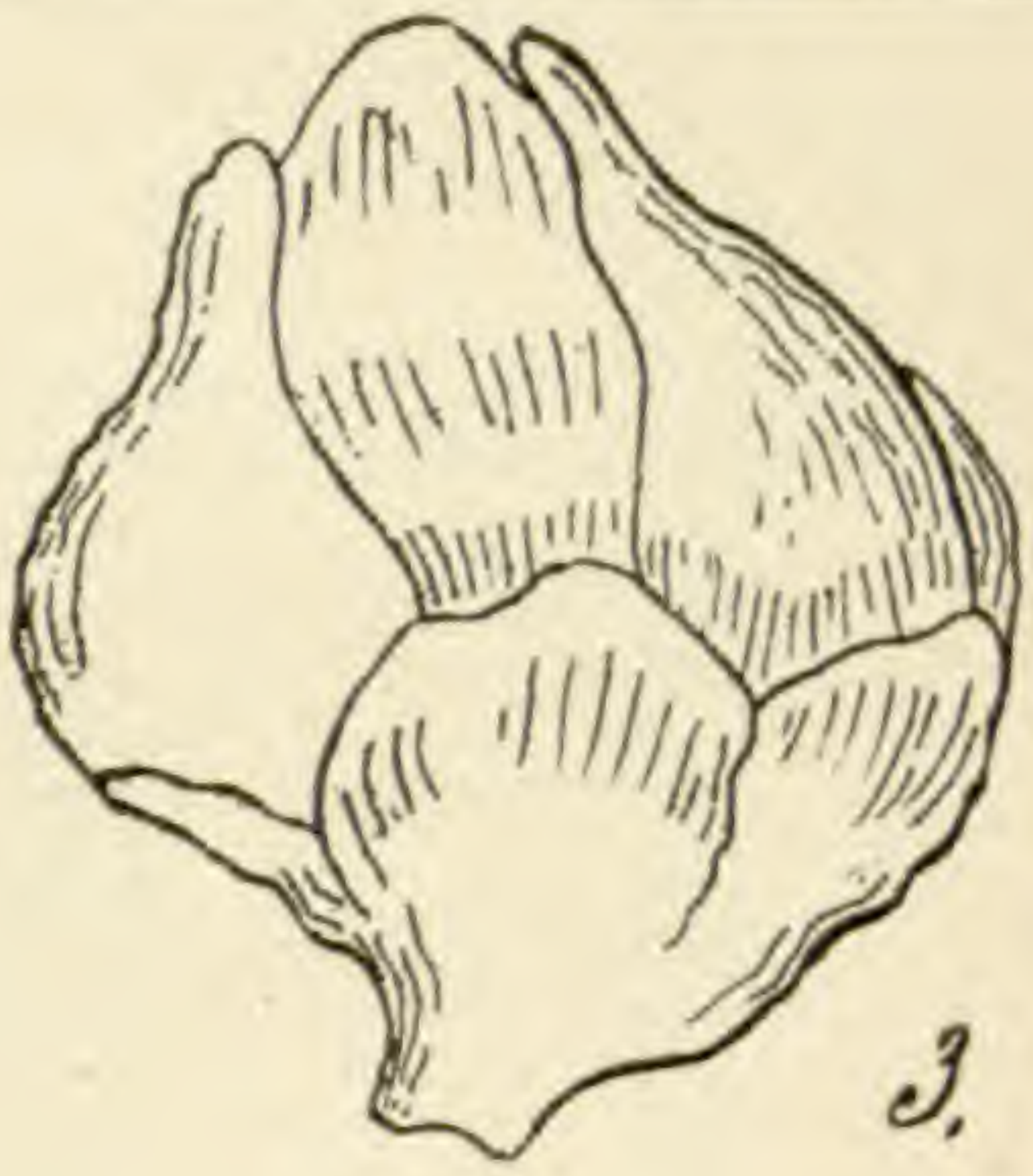

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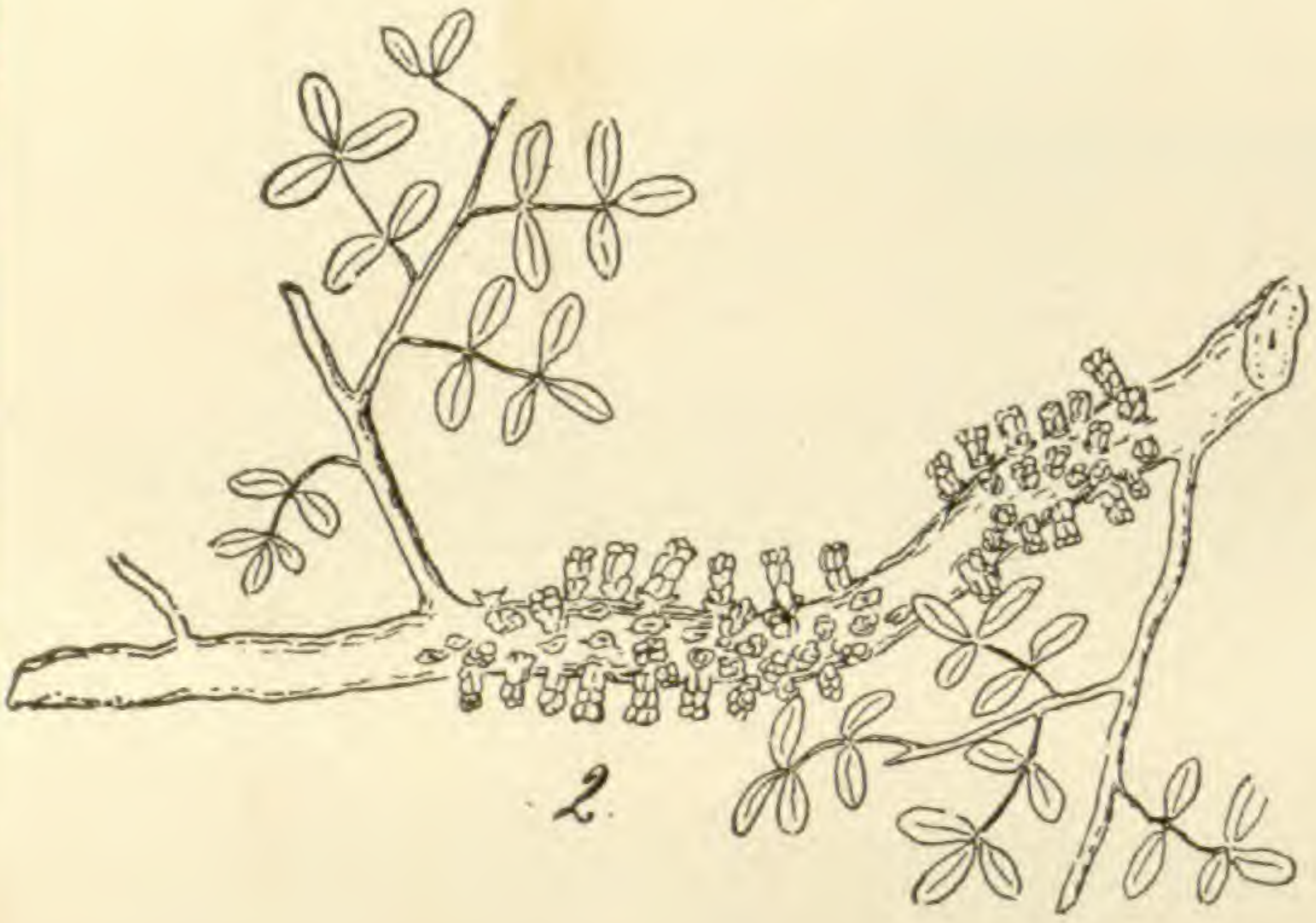

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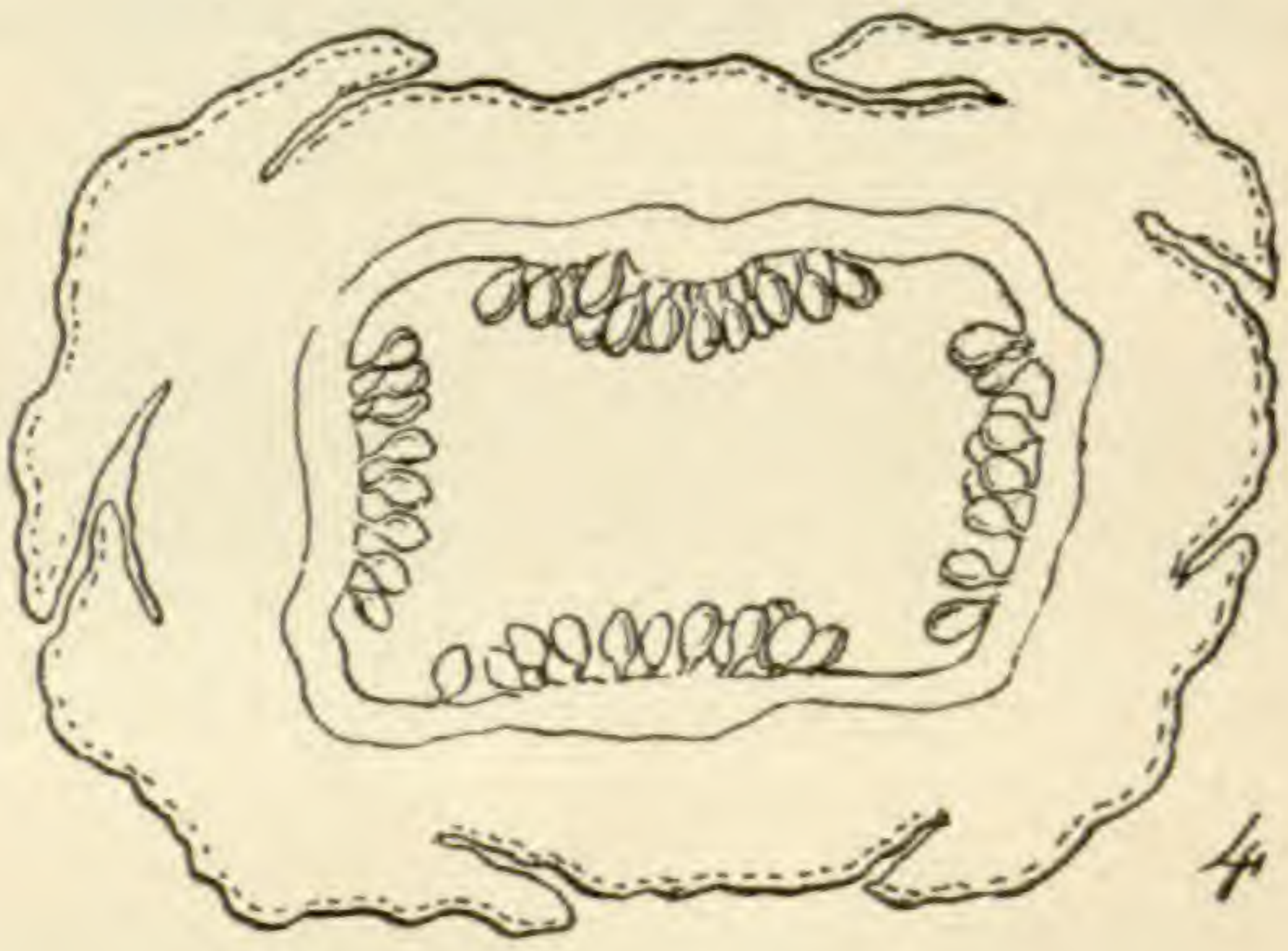

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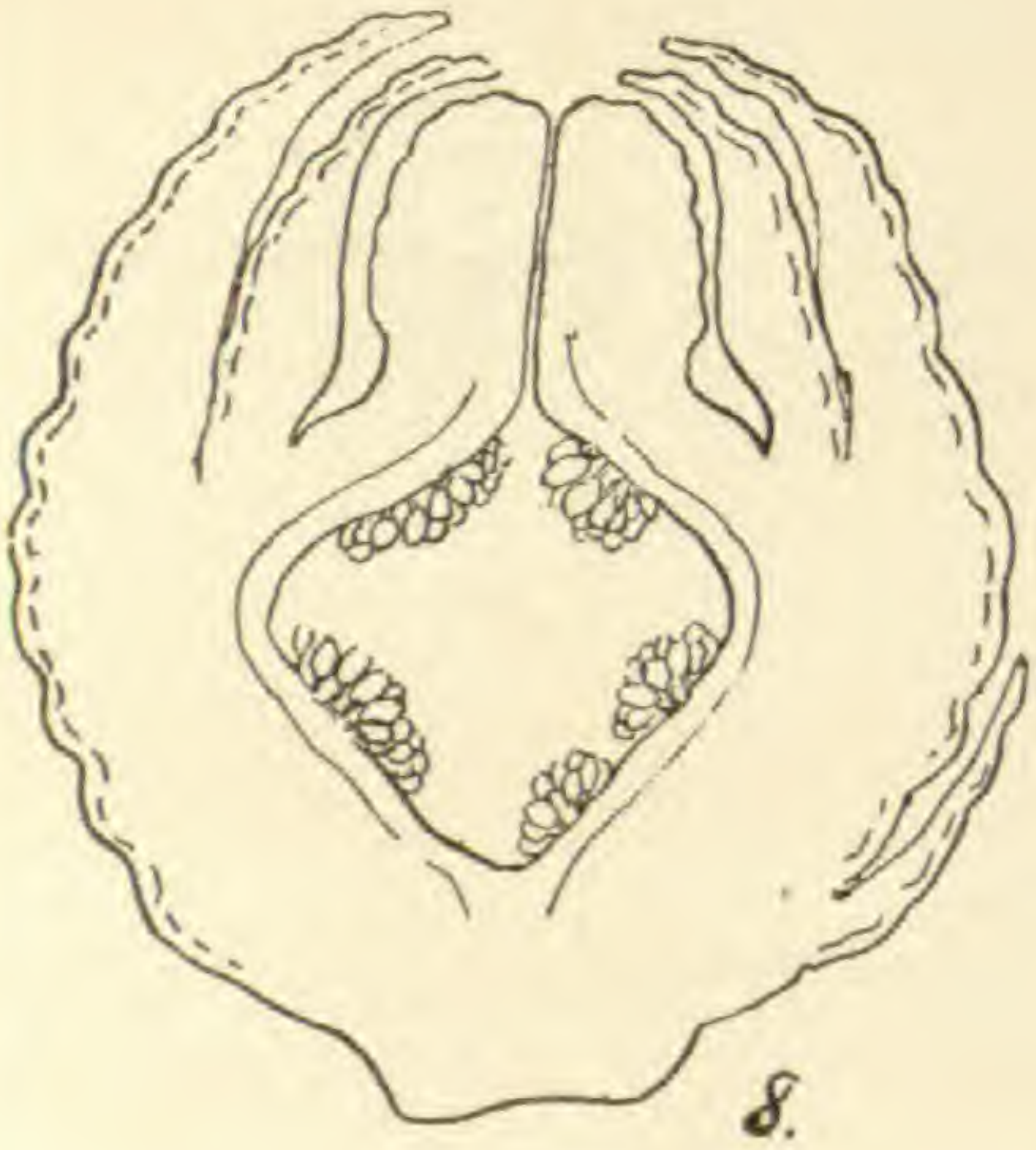

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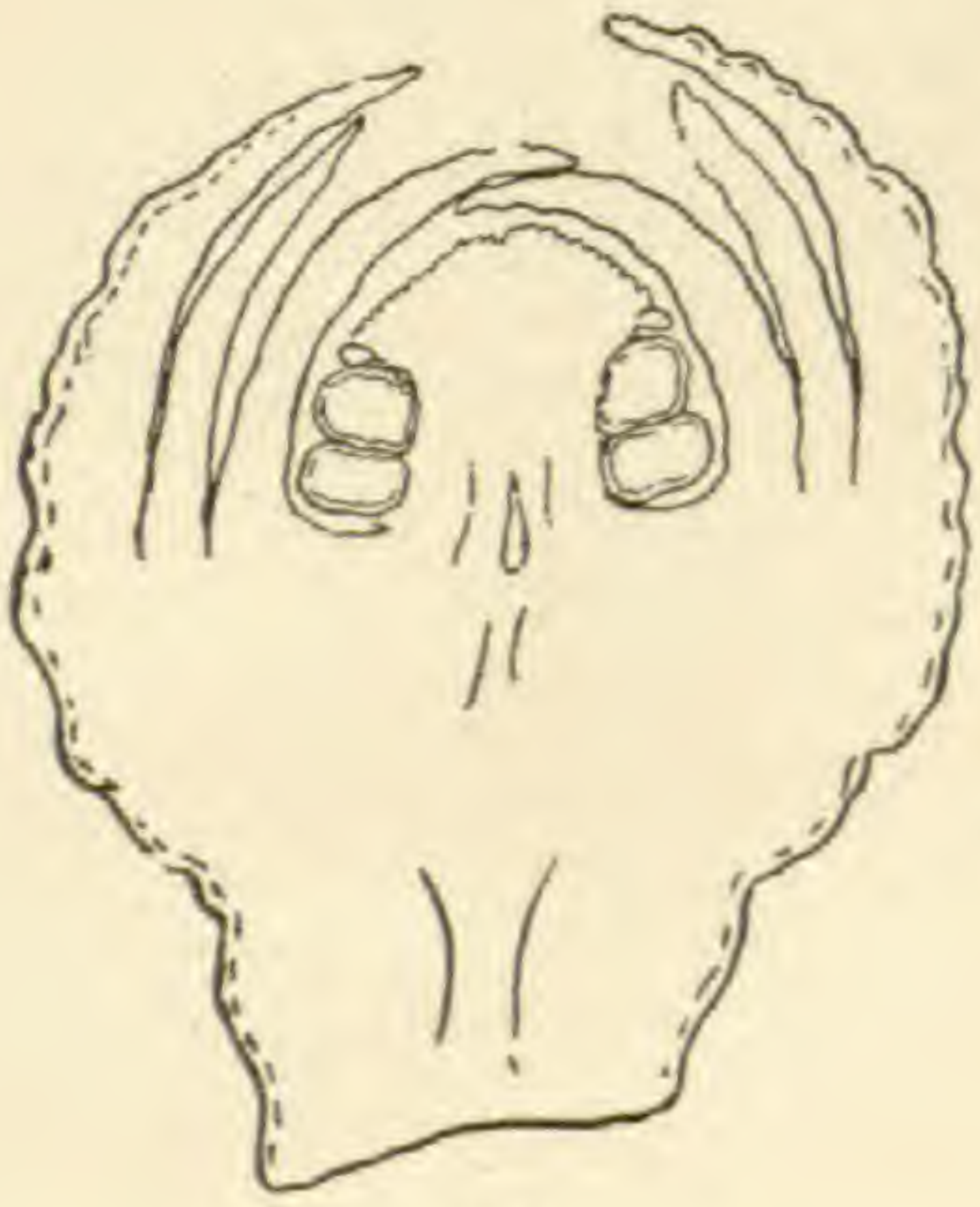

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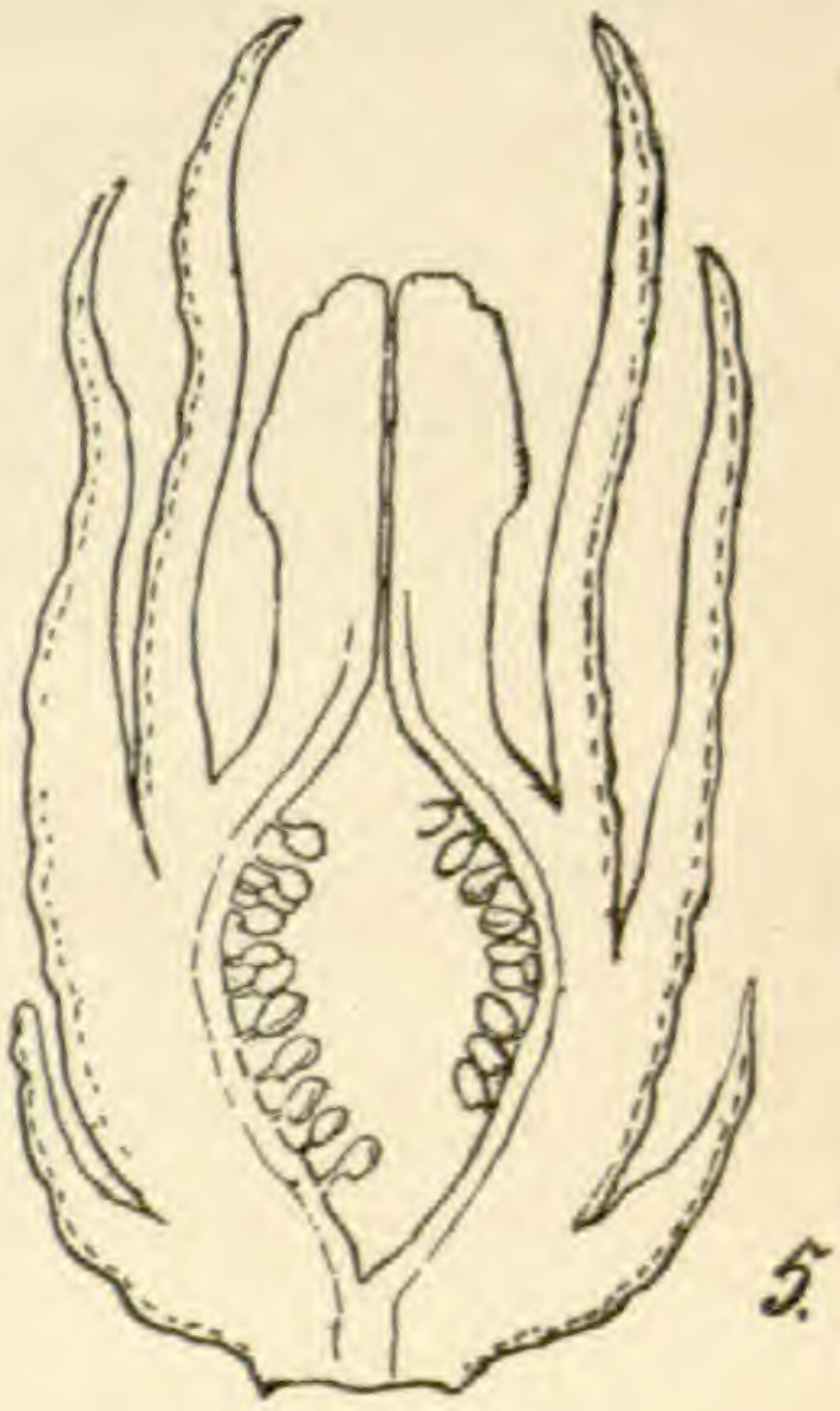

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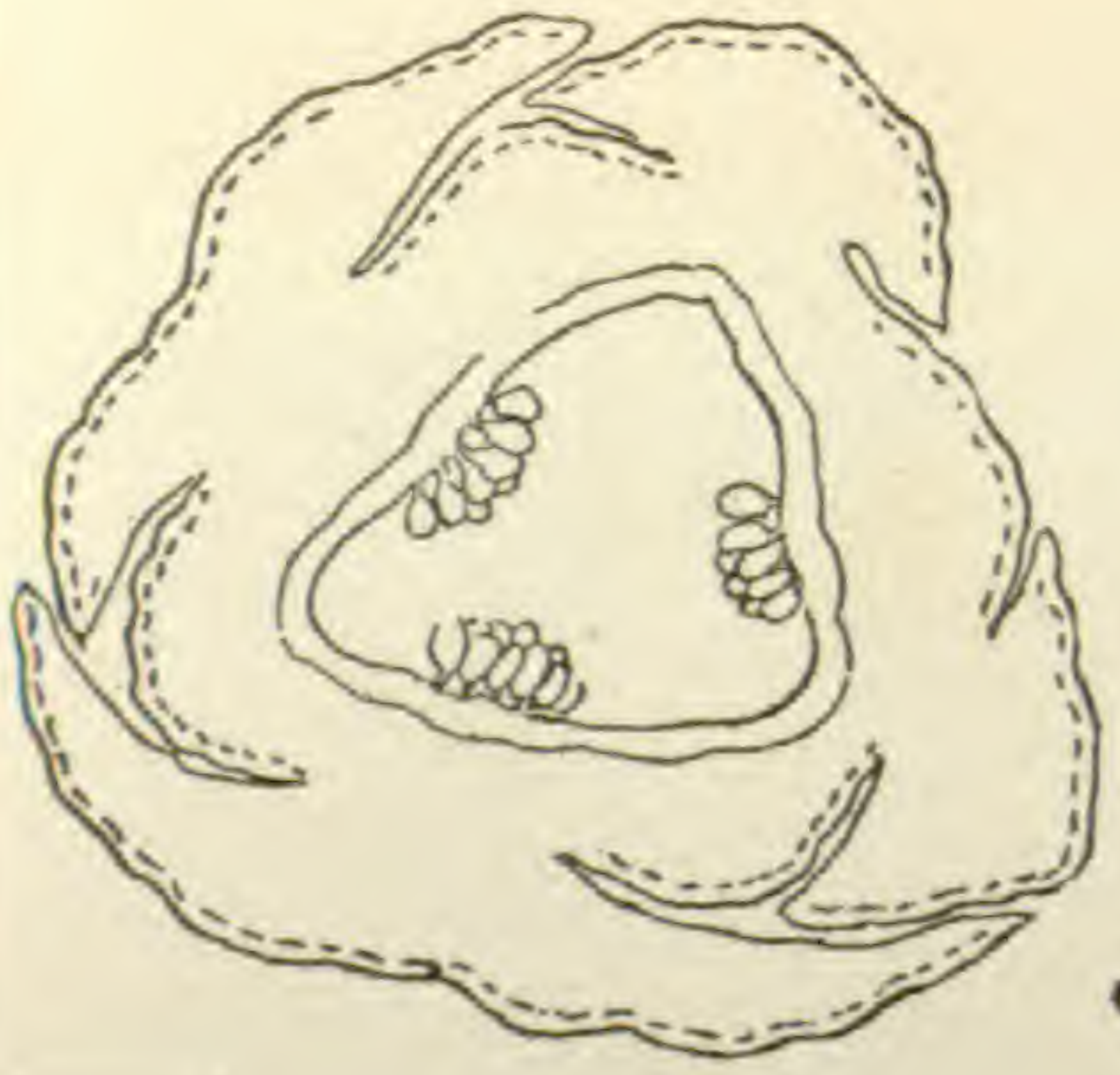

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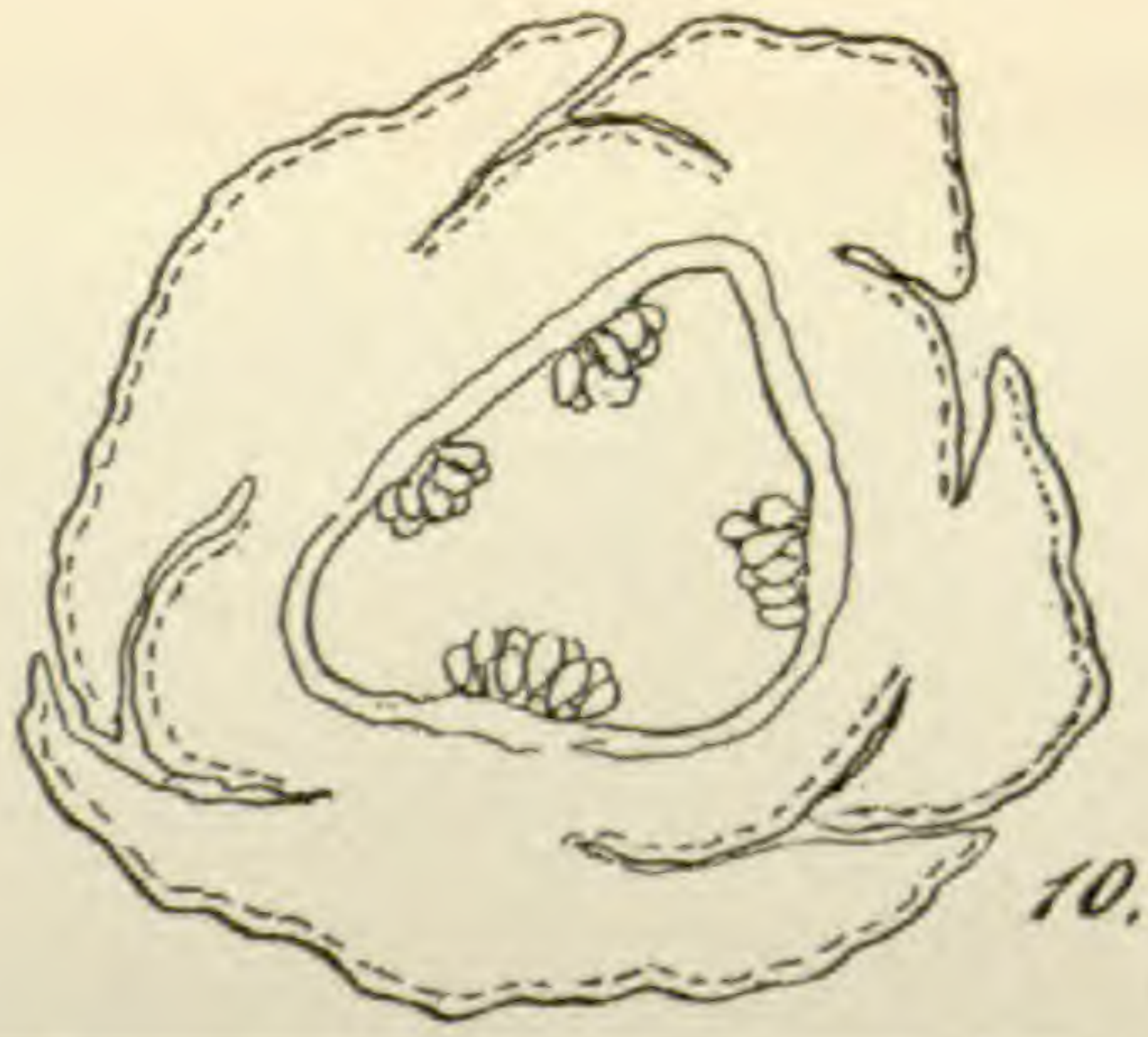

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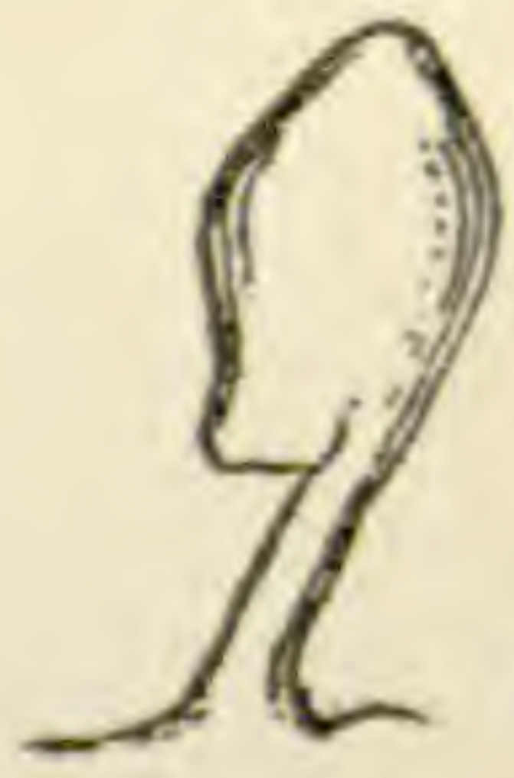

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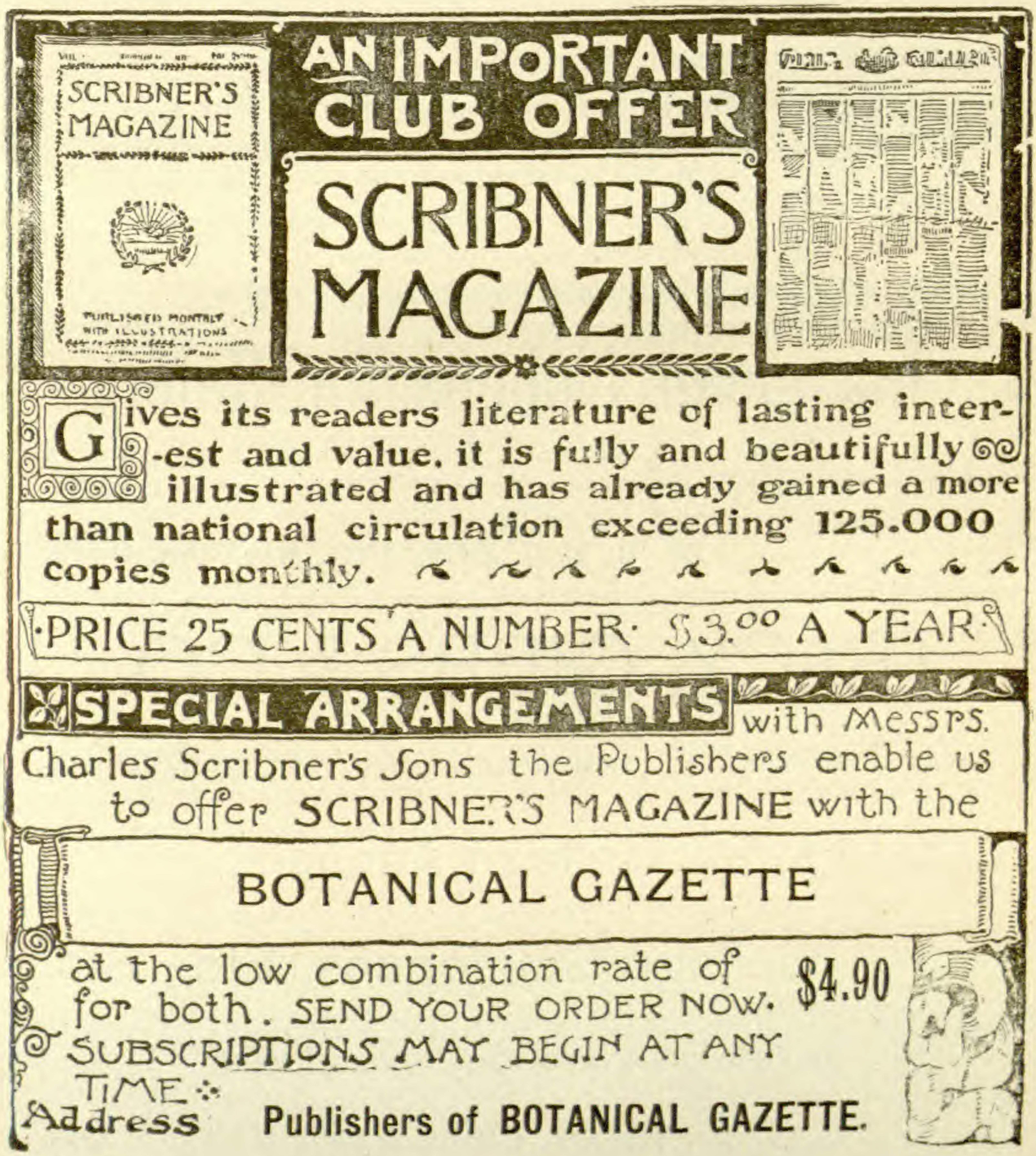

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VOL. XVI. APRIL, 1891. NO. 4.

THE
BOTANICAL GAZETTE

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[ISSUED APRIL 18.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

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New or noteworthy Compositæ from Guatemala.

JOHN M. COULTER.

Mr. John Donnell Smith has placed in my hands for determination his recent and large collections of Compositæ from Guatemala. From the long and interesting list of species that these collections contain, the following have been selected for publication as being new or especially noteworthy. In the final and critical study of species the herbarium and library of Harvard University were used, and thanks are due to Dr. Sereno Watson for his courtesy in supplying every facility for such study. Mr. Henry E. Seaton, my assistant, made all the dissections and rendered valuable service in generic determinations.

VERNONIA TRIFLOSCULOSA HBK.—Published descriptions say that the leaves are "very entire," but specimens from San Luis, Depart. Escuintla (*J. D. S.* 2377), show that the larger leaves are apt to have some callous serrulations.

VERNONIA LEIOCARPA DC.—Abundant and very fine material from Pacaya, Depart. Amatitlan (*J. D. S.* 2405), show that the heads are at first cylindrical, becoming "ovate" only with ripening and spreading, and that they are mostly 3-(sometimes 4)flowered, rather than "5-flowered."

VERNONIA SALVINÆ Hemsl., var. **canescens,** n. var.—Leaves white beneath with a dense pannose tomentum.—Coban, Depart. Alta Verapaz, March, 1881 (*Türckheim* 583).

STEVIA COMPACTA Benth.—Specimens from Volcan de Agua (*J. D. S.* 2327) show that the under surface of the leaves is apt to be more or less woolly, and that the branches and inflorescence may have more or less floccose wool.

Eupatorium Donnell-Smithii n. sp.—Usually tall and rather stout perennial herb, hirsutely pubescent especially above and in the inflorescence (the spreading hairs of the stem somewhat glandular and viscid), often glabrate below, leafy up to and in the inflorescence: leaves opposite, broadly ovate, crenate-serrate, acute or acuminate, more or less pubescent or even hirsute especially beneath and on the prominent veins, 4 to 10 cm. long, 2.5 to 6.5 cm. broad, the lower long-petioled, the uppermost short-petioled: heads 4 to 7 mm. high, numerous in a usually broad and ample leafy panicle, with white flowers: involucral bracts narrowly oblong, acute or acuminate, in about two nearly equal rows, thickened and conspicuously striate-nerved below, thinner and sometimes almost scarious at tip (especially the inner ones, which are also more decidedly acuminate or even mucronate-tipped), the outer ones more or less hirsute (often densely so), the inner ones glabrous or chiefly pubescent at tip : heads 40 to 50-flowered, with a flat or slightly convex receptacle and corolla-lobes bearded externally: achenes pubescent on the ribs, with scanty and barbellate pappus.—Aceituna, Depart. Guatemala, alt. 4600 ft., Feb. 1889 (*J. D. S.* 2374); Coban, Depart. Alta Verapaz, alt. 4300 ft., April, 1889 (*J. D. S.* 1603) ; Sarnac, Depart. Alta Verapaz, alt. 4600 ft., April, 1889 (*J. D. S.* 1602); Volcan de Agua, Depart. Zacatepequez, alt. 9500 ft., April, 1890 (*J. D. S.* 2329); Guatemala, Depart. Guatemala, alt. 5000 ft., Feb., 1890 (*J. D. S.* 2365).—This species seems closely related to *E. ciliatum* Less., to which it was referred by Hemsley (*Bourgeau* 1927) and John Donnell Smith (*Türckheim* 407, in 1887); but *E. ciliatum* has 18 to 22 flowers in a head and a glabrous corolla, while *E. Donnell-Smithii* has 40 to 50 flowers in a head and a bearded corolla.

Var. **parvifolium** n. var.—Much smoother, with smaller leaves, and but 20 to 35 flowers in a head.—Dueñas, Depart. Zacatepequez, alt. 5000 ft., April, 1890 (*J. D. S.* 2333).

EUPATORIUM AZUREUM DC.?—Apparently a form of this species was collected on Volcan de Agua, Depart. Zacatepequez, alt. 9000 ft., April, 1890 (*J. D. S.* 2326), in which the heads are but 12 to 16-flowered.

Eupatorium lyratum n. sp.—A stout apparently low branching perennial herb, softly pubescent throughout (the stem often even hirsute and more or less glandular) : leaves alternate, the lower ones obovate, lyrately-pinnatifid and petioled, 5 to 9 cm. long, 2.5 to 4 cm. wide, gradually becoming less lyrate, irregularly toothed, sessile and even auriculate-clasping above, the uppermost ones (in the inflorescence) merely ovate (acute) and slightly toothed or entire: heads about 6 mm. high, rather few in a very loose irregular leafy panicle, with white flowers : involucral bracts linear-lanceolate to linear, acuminate, very lax in 3 or more unequal rows (some of them exceeding the head), the inner ones linear and somewhat scarious, all more or less pubescent (the inner ones chiefly so at the tips), the outer ones often very much so (even hirsute) and more or less glandular: heads many-flowered, with a flat receptacle, and very long and slender corolla-tubes with very minute lobes (if any) : achenes pubescent, with scanty but long and conspicuous, very minutely barbed soft white pappus.—Laguna Amatitlan, Depart. Amatitlan, alt. 3900 ft., March, 1890 (*J. D. S.* 2393). A species remarkable in its leaf characters and very long and slender corolla tube.

Eupatorium Rafaelense n. sp.—A small shrub, glabrous or minutely pubescent : leaves opposite, rather long petioled, ovate to lance-ovate, acute or acuminate, from crenate-serrate to minutely so or even entire, 3 to 7.5 cm. long, 2.5 to 3.5 cm. wide (but the numerous specimens show only the leaves of the branchlets) : heads 9 to 18 mm. high, in loose or rather compact cymose clusters, terminating opposite divergent branchlets, the clusters becoming more compacted into a thyrsoid inflorescence above : involucral bracts linear-oblong, often purplish, acute or obtuse, in about 3 unequal lax rows, about half as long as the head, striate-nerved below, more or less pubescent and glandular (especially the outer ones), all with ciliate margins : heads 35 to 45-flowered, with a flattish or slightly convex receptacle and glabrous corolla : achenes scabrous-puberulent on the ribs, with conspicuous and barbellate white pappus.—San Rafael, Depart. Zacatepequez, alt. 6500 feet, April, 1890 (*J. D. S.* 2331); Guatemala, Depart. Guatemala, alt. 5000 feet, Feb., 1890 (*J. D. S.* 2368).

EUPATORIUM POPULIFOLIUM HBK.—This species seems to be very variable in the size of its leaves and flower clusters. Specimens from Laguna Amatitlan (*J. D. S.* 2400) are reed-like in habit, becoming 18 feet high, with leaves a foot or more long, compact thyrsoid panicles over a foot long and broad, and uniformly 11-flowered heads. Specimens from Cuyuta, Depart. Escuintla (*J. D. S.* 2399), are 12 feet high, with leaves not half as large, flower clusters only 5 or 6 inches long and 3 or 4 broad, and uniformly 9-flowered heads.

EUPATORIUM TUERCKHEIMII Klatt.—Specimens from Pansamalá (*Türckheim* 1342) show broader leaves than the type. They are ovate and long-acuminate, often nearly 2 inches broad.

EUPATORIUM AGERATIFOLIUM DC., var. **purpureum** nov. var.—Inflorescence with a dense purple glandular pubescence and the involucral bracts purple.—Cobán, Depart. Alta Verapaz, alt. 4600 feet, May, 1887 (*Türckheim* 52).

Brickellia Pacayensis n. sp.—Closely related to *B. Hartwegi* (*Eupatorium rigidum* Benth. Pl. Hartw. 88) but the whole upper part of the plant is blackened with stipitate glands, the heads are 20 to 30-flowered, and the involucral scales are often much narrowed (linear-lanceolate to linear), longer, and more decidedly acuminate: the pappus is minutely but densely serrulate and the achenes densely soft pubescent.—Pacaya, Depart. Amatitlan, alt. 6000 feet, March, 1890 (*J. D. S.* 2389).

APLOPAPPUS STOLONIFERUS DC., var. **glabratus** nov. var.—Leaves glabrate, not all "very hirsute" as in the type.—A curious and handsome *Aplopappus* found on the crater of Volcan de Agua, Depart. Zacatepequez, alt. 12100 feet, April, 1890 (*J. D. S.* 2328).

Aphanostephus Pinulensis n. sp.—A stout very leafy and branching perennial 3 to 4.5 dm. high, rather glaucous and softly pubescent, the young leaves and branches and inflorescence more or less floccose: leaves punctate, lance-ovate to obovate in outline, the lower (blade) 9 cm. long, and on long petioles, gradually becoming smaller upwards, bipinnatifid, the oblong obtuse pinnæ more or less confluent and irregularly pinnately cleft and toothed (the whole plant with its conspicuous heads having an Achillea look): heads on short peduncles collected in a terminal corymbose cluster: bracts of the involucre lanceolate and strongly carinate: rays 5 to 8 mm. long, white, mostly reflexed with age: base of the corolla-tube in age prominently thickened and indurated, more or less persistent on the strongly angulate-costate whitish achene: pappus a very short crown with toothed edge.—Pinula, Depart. Guatemala, alt. 4400 feet, Feb., 1890 (*J. D. S.* 2407). A remarkable looking Aphanostephus on account of its broad bipinnatifid leaves.

Clibadium Donnell-Smithii n. sp.—Stem and inflorescence hirsute: leaves broadly ovate, mostly long-acuminate, with spinulose-crenulate serrulations, velvety pubescent beneath (even hirsute on the veins), scabrous above, 12 to 25 cm. long, 6 to 16 cm. broad, on long petioles: heads 4 to 5 mm. high, in a rather small open cymose panicle: involucral bracts ovate, acute or cuspidate, ciliate on the margins, sparingly so on the back: corolla-lobes of sterile flowers with scanty pubescence if any: achenes obovate, conspicuously pilose at apex.—Guatemala, Depart. Guatemala, alt. 5000 feet, Feb., 1890 (*J. D. S.* 2347). This species is near *C. Surinamense* L., var. *asperum* Baker, but it differs in its comparatively smooth corolla-lobes of the sterile flowers, and strikingly in its large broad leaves, velvety pubescent beneath, and long petioles. From *C. arboreum* Donnell Smith it differs in its involucral bracts, leaves, and villous achenes.

MONTANOA OVALIFOLIA DC. is worthy of mention as being a plant reported before only from Bogota. These specimens are from Pacaya, Depart. Amatitlan, alt. 6000 feet, March, 1890 (*J. D. S.* 2352).

Tetragonotheca Guatemalensis n. sp.—Apparently closely allied to *T. Texana* Gray and Engelm.; but the leaves are deltoid, with mucronate serrulations and usually one or two prominent basal teeth, abruptly decurrent into a winged petiole which does not enlarge or clasp at base; leaves of the inflorescence ovate-lanceolate to lanceolate, acuminate, tapering gradually to a petiole: corolla-tubes, both of the ray and disk-flowers, very long and slender, more or less glandular pubescent, as is the whole inflorescence: pappus none in our specimens.—Senahú, Depart. Alta Verapaz, alt. 3500 feet, April, 1889 (*J. D. S.* 1592). A remarkable *Tetragonotheca* on account of its long and slender corolla tubes, the showy yellow ligules looking conspicuously slender-clawed.

Zexmenia Dulcis n. sp.—Pubescent and branching: leaves thickish, opposite, short-petioled, ovate or oblong, acute, distantly mucronate-serrate, scabrous on both sides but very much more so above, 6 to 9 cm. long, 3.5 to 5 cm. broad: heads on rather long peduncles (2.5 to 5 cm.), about 10 mm. high: involucral bracts lanceolate to ovate, mostly acute, scabrous with rough hairs: bracts of the receptacle winged on the back, with a sharply acute or acuminate minutely toothed apex: achenes of the ray 3-angled and 3-awned; those of the disk broadly winged, with usually two prominent unequal awns and numerous small squamellæ.—Rio Dulce, Depart. Livingston, alt. 0 feet, March, 1889 (*J. D. S.* 1607). Resembling *Z. scandens* Hemsl. somewhat, but differs from that species in its acute leaves, long-peduncled and smaller heads, acute involucral bracts, merely 3-angled ray achenes, and broadly-winged disk achenes. Much more nearly related to *Z. trachylepis* Hemsl., but differs in its longer-pedunculate heads, acute involucral bracts, very acute or acuminate ("rounded at apex" in *Z. trachylepis*) chaff and unequal awns.

TITHONIA TUBÆFORMIS Lass.—Specimens collected at Pacaya, Depart. Amatitlan (*J. D. S.* 2390), show a peculiar habit. All the specimens in the Gray Herbarium are tall branching plants, while many of these are low and widely divaricate-branched at the very base.

MELANTHERA HASTATA Rich.—It is evident that this species must include *M. oxylepsis* DC., as in specimens from Pinula and Rio Amatitlan (*J. D. S.* 2342 and 2341) there are all gradations in the leaves from ovate-deltoid (*M. oxylepsis*) to hastately 3-lobed (*M. hastata*).

ENCELIA MEXICANA Mart.—This variable species was collected at Laguna Amatitlan (*J. D. S.* 2408), and in comparing it with specimens in the Gray Herbarium it seems evident enough that it should be considered to include *E. subaristata* Gray, *E. heterophylla* Hemsl., *E. fœtida* Hemsl., and *E. cordata* Hemsl., as indicated by Dr. Gray in an herbarium note.

SPILANTHES REPENS Michx. has been heretofore reported only from the southern United States. It now comes from Coban, Depart. Alta Verapaz, alt. 4300 feet (*J. D. S.* 1614).

SPILANTHES BECCABUNGA D C.—Specimens from Dueñas, Depart. Zacatepequez, alt. 5000 feet (*J. D. S.* 2125) show that the achenes are often pubescent.

BIDENS HETEROSPERMA Gray.—Specimens from Guatemala, Depart. Guatemala, alt. 5000 feet (*J. D. S.* 2351), show that the achenes are not always glabrous.

Bidens Antiguensis n. sp.—§ PSILOCARPÆA. Closely resembling *B. leucantha* Willd. but the rays (mostly present) narrowly oblong, acute, bright yellow (8 to 12 mm. long), and the 2 (rarely 3) rigid awns perfectly smooth and widely divaricate: exceedingly variable in pubescence, from glabrous to pilose-pubescent.—Antigua, Depart. Zacatepequez, alt. 5000 feet, April, 1890 (*J. D. S.* 2354); San Luis, Depart. Escuintla, March, 1890 (*J. D. S.* 2375).

Senecio Donnell-Smithii n. sp.—A very stout woolly-pubescent perennial: leaves alternate, thick, very broadly ovate to rotund in outline, cordate at base, undulately lobed and margined with blackish mucronulations, glabrous above, densely whitish woolly beneath, 9 to 15 cm. long, 8 to 11 cm. broad, on stout petioles: heads 8 to 10 mm. high, in a large terminal very compact panicle: involucral bracts lanceolate, hirsute and purple-tipped: ray-flowers 6 to 8, with narrowly oblong yellow ligules 4 to 6 mm. long; disk-flowers 12 to 16. —Volcan de Agua, Depart. Zacatepequez, alt. 11000 feet, April, 1890 (*J. D. S.* 2362). Near *S. Aschenbornianus* Schauer, but differs in being stouter, with much more compact inflorescence, leaves very smooth above and densely woolly beneath, hirsute purple-tipped involucral scales, and more numerous disk-flowers. A very striking and handsome species.

SENECIO GHIESBREGHTII Hort. Hal. Regel (*S. grandifolius* of authors, not Less.)—Specimens from Serraquitché, Depart. Alta Verapaz, alt. 2500 feet, (*J. D. S.* 1598), show that the characters of the species must be made to include not only ovate, but also elongated ovate or even obovate leaves, which are often acute at base as well as apex, and whose margins vary from sinuate-dentate to entire. These Guatemalan specimens also show that the disk-flowers may be fewer than 10, most of the heads containing but 5 or 6.

SENECIO GHIESBREGHTII Hort. Hal. Regel, var. **pauciflorus** n. var.— Differs from the species in having fewer-flowered heads and hairy involucral bracts.— Sapote, Depart. Guatemala, alt. 4300 feet, March, 1890 (*J. D. S.* 2359); Chucaneb, Depart. Alta Verapaz, alt. 6000 feet, April, 1889 (*J. D. S.* 1606). *S. Ghiesbreghtii* has 4 to 6 ray-flowers and 10 disk-flowers; while the variety has uniformly 2 ray-flowers and 3 disk-flowers.

Senecio Cobanensis n. sp.—A woody-stemmed glabrous and very leafy plant: leaves scattered, thickish, elongated, narrowly lanceolate to oblanceolate and acuminate, on slender petioles, usually with distant serrulations, 10 to 14 cm. long, 2 to 2.5 cm. broad, readily falling off and leaving the stem covered with prominent scars: heads discoid, about 6 mm. high, in terminal rather loose corymbose panicles: involucral bracts about as long as the head, linear-oblong, obtuse or acutish, thick and rigid, keeled and somewhat saccate below (forming a truncate base to the head), often with very small accessory bractlets: disk-corollas about 6, deeply 5-lobed, the lobes usually with inflexed tips: achenes glabrous.— Coban, Depart. Alta Verapaz, alt. 4300 feet, May, 1887

(*Türckheim* 1158). A species perhaps nearest to *S. Candelariæ* Benth., but very distinct.

PEREZIA NUDICAULIS Gray.—Specimens from Guatemala, Depart. Guatemala (*J. D. S.* 2364) show that the leaves are not "all runcinate," some of them being simply ovate.

SENECIO KERMESINUS Hemsl. (*Gynoxys Hænkei* DC.)—Abundant material from Guatemala, Depart. Guatemala, alt. 5000 feet (*J. D. S.* 2356), shows that the original description of De Candolle needs emendation, as that was professedly drawn from imperfect specimens showing only the upper leaves. The lower leaves are coriaceous, rugose veiny, and more or less coarsely toothed. The heads also frequently have more numerous flowers. The plant is a very handsome one, climbing high over trees.

Wabash College, Crawfordsville, Ind.

Notes on North American Willows. VI.

M. S. BEBB.

A review of the willows of California.

More than ten years have elapsed since the publication of the second volume of the Flora of California. I wish to look over the account given therein of the willows, make some comments in the light of a better information, and correct mistakes.

1.[1] SALIX NIGRA Marsh.—This species, in its distribution from Texas southward and westward, presents two diverging lines of variation. Southward, along the Gulf coast, it passes by insensible gradations into the Mexican form of *S. Humboldtiana.* Westward, across the plains of New Mexico and Arizona, it takes on the character of var. *venulosa* Anders. with the lower leaves of the branches oblong, rather obtuse, often mucronate, later leaves at the tips of the branches attenuate-linear, all yellowish-green (at least in herbarium specimens) and veiny; mature capsules yellowish and long pediceled. Var. *Wrightii* And. is the same thing only representing (as it appears to me) an abnormal or retarded growth of the individual tree from which Wright's specimens were taken. Nevertheless, as Andersson insists upon the "short, thick, densely flowered aments," as essentially distinguishing this variety, it may be as well to avoid forcing a decision upon the scanty material at present available. *S. nigra* var. *venulosa* extends to the Sierra Nevada Mountains, but whether Bolander's specimens (leaves only), from Cache Creek near Clear Lake, show a reversion on the Pacific slope to something like the typical form of the species, or whether these were taken, late in the season, from the extreme tips of branches of var. *venulosa*, or whether it is not even more probable still that these long, narrow, sharply serrate leaves indicate an outlying northern station for *S. Humboldtiana* var. *oxyphylla* is a question that can receive no satisfactory answer until much more is known than we now know of the forms which *S. nigra* assumes in southern California and northern Mexico.

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[1] The numbers correspond with those of the Flora of California.

2. S. LÆVIGATA Bebb.—This fine willow reaches its fullest development in central and southern California. It is not know as an Oregon species, though collected by Mr. Joseph Howell, just south of the boundary line in Siskyyou county. Southward it takes on a serotinous mode of inflorescence, like other northern species which invade the tropics.

3. S. LASIANDRA Benth.—Local observers may be inclined to regard the more pronounced varieties as distinct, but if so I am unable to limit them. In a broad and comprehensive view the propriety of uniting the Rocky mountain and Pacific coast forms under one species and keeping this distinct from *S. lucida* of the Atlantic coast will, I believe, be conceded. *S. lucida* var. *macrophylla* Anders. referred "from the description" to *S. lasiandra* var. *lancifolia* I have since seen, not only in Dr. Lyall's (type) specimens, but in others from the Columbia River, in which the peculiarity described is exhibited in a still more marked degree. It is simply a broad-leaved, showy-flowered state of var. *lancifolia* with nothing whatever to indicate any particular affinity with *S. lucida*.

4, 5, 6. THE LONGIFOLIÆ.—This group is distinctively American, clearly defined on every side, shading off into no other by variation, hybridizing with none. It is not connected with Old World forms by any synthetic type of the present or of any preceding period, but apparently was derived from the Mexican plateau at the close of the Tertiary.

In keeping with this view it finds its fullest development and greatest variation in form and stature on the Pacific slope. Eastward it declines in vigor and variability until on the Atlantic coast it is of rare occurrence from New Brunswick to the Potomac. Clearly marked as are the outer limits of the group it presents no lines of cleavage within by which it can be satisfactorily divided. No natural characters are found to coincide with such assumed distinctions, for instance, as the "linear lobes of the stigma," made prominent in the attempt to separate *S. sessilifolia.* Each portion after sub-division remains as heterogeneous as was before the aggregate group. It may be possible, by emphasizing first one character and then another, as these are found to predominate in the different forms, to designate a number of sub-species and varieties; but so bewildering and intangible is the reticulated intergrading that the difficulty of segregation seems only to be heightened by every fresh acquisition of material.

7. S. CORDATA Muhl.—No American willow has a wider distribution than this, from the Gulf States to California and northward in the interior to the Mackenzie River, and perhaps none other—not even excepting aggregate *S. longifolia*—presents more the appearance of a "congeries of species in the making." It differs from *S. longifolia* however in being, of all our willows, the one which hybridizes most freely with others and this implies that even where actual hybridity can not be proven it is more or less affected by association with other willows in different portions of its wide area of distribution.

8. S. LASIOLEPIS Benth.—Ten years ago this species was known to the writer only from Californian specimens. Even at that time three dominant lines of development were recognized, but these have since been found to lead out to such widely divergent extremes as would certainly be admitted as distinct species were it not for the intergrading. The most remarkable of these, exhibiting the var. *Bigelovii* in its farthest departure from the typical *lasiolepis* of southern California, is sent to me by Mr. C. V. Piper, from near Seattle, Washington: leaves obovate, oblong or oblanceolate, coarsely and irregularly repand-serrate, 2 inches wide by 4–7 inches long; aments as thick and copiously silky with long hairs as those of *S. Hookeriana!* As if *S. lasiolepis* were not already overloaded with aberrant forms we have to mention still another, provisionally referred only, found by Prof. Greene on

Santa Cruz Island. Unfortunately only the leaves were obtained. These are clothed beneath with a dense velvety, *persistent tomentum.* The character "filaments more or less united at base" should be more distinctly emphasized: it is really quite constant and will often serve to identify staminate specimens unaccompanied by leaves.

9. S. FLAVESCENS Nutt.—The name was adopted at first from Nuttall's description but I have since seen specimens named by Nuttall himself which confirm beyond all question the identity of the species. The time-honored name of the Flora Boreali-Americana, *S. Scouleriana*, will probably always be retained for the Pacific Coast forms which differ most widely from the type, but as this difference is observed almost wholly in the form of the leaves and as the leaves of the type specimens of *Scouleriana*, in the Hookerian herbarium are really those of *S. Sitchensis*, we are obliged to acknowledge a certain inconsistency, for which we find excuse in a desire to perpetuate among the willows of the N. W. Coast the name of the early explorer. This is another polymorphous species, which would be more faithfullv reported if broken up into a series of varieties.

10. S. MACROCARPA Nutt., var. ARGENTEA—This beautiful little willow, with its silvery-silky capsules and foliage, and twigs overspread by a delicate glaucous bloom, may be regarded as a marked variety of the typical *S. macrocarpa* Nutt. of the Columbia River valley. An intermediate form has been conlected by Mr. Patterson in the mountains of Colorado. As has already been shown (BOT. GAZETTE vol. x. p. 221) Anderson transferred Nuttall's name to a single specimen, from Hudson's Bay, in the Kew Herbarium, and then redescribed (essentially) the Oregon plant under the name of *S. Geyeriana.*

11. S. SITCHENSIS Sanson.—Following either the analytical key or the subordinate grouping of the species, the solitary stamen now known to be constantly characteristic of *S. Sitchensis* would carry this in all its forms, over to no. 19, *S. Coulteri*—and rightly so: for while *S. Coulteri* represents nothing more than an abnormal development of *Sitchensis*, the species itself, in virtue of the single stamen, the long, slender, flexuose aments and peculiar vesture and veining of the leaves, must become the type of a new group (SITCHENSES) and be removed from its present setting. It was a mistake to arrange the little willow "collected on a high mountain

near Donner Pass" by Dr. Torrey, as a variety of *S. Sitchensis.* Similar forms occur from British America southward to Utah and California—mostly in the Rocky Mountains, all seeming to belong to one species for which *S. pellita* Anders. is the oldest name; unless this is found to be anticipated by the still older and very obscure *S. Drummondiana* Barratt. Furthermore the very interesting question whether this is a mountain equivalent of the coast *Sitchensis* remains to be demonstrated when we know the staminate aments. Why these have eluded so many collectors is a mystery! Drummond's specimens are without staminate flowers to begin with and although in recent years some of our best collectors in the West have, at my request, endeavored to secure specimens which would complete our knowledge of the species, their efforts have been, thus far, of no avail.

12. S. LEMMONI Bebb.—This appeared abundantly, and in great diversity of form in Mr. Lemmon's collections, but has not been further made known as a Californian plant. It has been found since, however, by Mr. Cusick in the mountains of eastern Oregon at an altitude of 4,000 feet.

13. S. AUSTINÆ Bebb.—This must be held in abeyance. The leaves described belong to *S. Lemmoni*, and in some (though not all) of the specimens staminate aments of *S. lasiolepis* were intermixed. There yet remain the fertile aments not identifiable with any willow of the Pacific Coast region as at present understood. Leaves to match these will, I apprehend, be found to be of the *phylicifolia* type and the emended species, I hope, may continue to bear the name; but how longs shall we have to wait for the painstaking local observer who will collect flowers and fruit, and finally foliage from the same plant ?

14. S. BREWERI Bebb.—Beyond all comparison this is the rarest and most obscure of North American willows. Only in a remote degree related to any species of the region in which it was found, in fact representing a group otherwise unknown throughout the length and breadth of the Western Continent, found but once and after the lapse of more than ten years still known only from that one meager collection—surely we have presented here every indication of a species verging close on extinction.

16. S. CALIFORNICA Bebb.—In the first paper of this series mention was made of a group of willows, intermediate as it

were between *S. glauca* and *S. cordata*, distributed over the alpine regions of the Sierra Nevada and Cascade Range, and of which *S. Californica* constituted the southernmost member. Within a year or two past the collections of Piper and Smith, on Mt. Rainier and of the Macouns—father and son—in British Columbia, have shown that *S. Barclayi* Anders. known heretofore as a species of the Alaskan coast, is the northernmost representative of the series. A further consideration of this group will be made the subject of a separate paper.

17. BROWNII Bebb, var. PETRÆA (Anders.). More variable in the Sierra Nevada than in the Rocky Mountains, and including *S. tenera* Anders. Andersson first named one of Dr. Lyall's Cascade mountain willows *S. phlebophylla*, and under this name the specimens were sent out from Kew. Afterwards he restricted the name *phlebophylla* to a species of high arctic distribution and re-named Lyall's plant *S. tenera.* Watson (Bot. King's Exped., p. 326,) finding one of his willows from the Uintas, 10,000—11,000 feet altitude, agreeing perfectly with the Lyall specimen in the Gray herbarium adopted the name which he found on the label, not suspecting—as, indeed, why should he?—that the Lyall plant had been made, later, the type of *S. tenera* and that the arctic species was exclusively arctic.

18. S. MONICA Bebb.—Were I to receive to-day the poor, stunted specimens upon which this doubtful species was founded they would go into an already well filled cover marked "undetermined" and there repose until something more definite could be known about them. But *S. Monica* is no longer subject to the whim of its author. What is it? Possibly a form of *S. chlorophylla* And. This is known to occur on Mt. Adams and the higher summits of the Cascades and has also been collected by Prof. L. F. Ward in the Wahsatch mountains at 8,000–11,000 feet altitude. It is rather remarkable than otherwise that it has not been found on the peaks of the Sierra Nevada in forms about which there could be no uncertainty; but until this is done, the expediency of adding the species to the state flora on the evidence afforded by the poor, battered specimens named *Monica*, is very questionable. For the very narrow scale and the bracts at the base of the staminate ament seem opposed to any such determination; nor can *Monica* be a starved, alpestrine form of *Californica*, for this is known from almost the same locality and its

identity unmistakable. On the whole it seems best that a species of such questionable validity should be dropped.

To the list of California willows, as known ten years ago, not a single addition has been made, though it is highly probable that *S. rostrata*, *S. vestita* and *S. reticulata* will be found in the Sierra Nevada; and *S. Hookeriana* (known to occur abundantly along the coast of Oregon down almost to the boundary line) may be confidently looked for at the mouth of the Klamath river.

Rockford, Ills.

Notes on the flora of the St. Croix region.

E. G. HILL.

The Dalles of the St. Croix and the neighboring rapids are a piece of scenery very attractive to one seeking the beautiful and picturesque in nature. They are formed by a belt of trappean rocks of the copper-bearing series which crosses the river in this region, making several ridges from 200 to 300 feet high. Softer sandstones of the Potsdam or Cambrian formation, mingled with conglomerates and shales at the points of contact, are laid down upon the trap in horizontal strata, or abut against the sides of its uplifted beds, clearly showing their unconformability. Through these rocks the river has worn a deep gorge, and by a series of rapids and low falls rushes along between bluffs descending rather steeply as wooded slopes. On the Minnesota side of the stream the bluffs recede from its banks far enough to leave a nearly level spot on which stands the lower part of the village of Taylor's Falls. On the opposite slope, in the state of Wisconsin, lies the village of St. Croix Falls. In the midst of the rapids the river is spanned by a bridge at a point where it becomes quite narrow at the head of a defile, making it easy to cross to either side. For some distance below the bridge the water rushes on over the sloping rocks in impetuous swirls, then makes a sudden bend and glides on with comparative placidity between cliffs from 100 to 200 feet high. The walls of these cliffs are either vertical or nearly so. The Dalles are properly that portion of the gorge beginning at the bridge, and furnish much the most imposing part of the scenery. It continues for several miles, but the rocks, composed of softer or less elevated materials have been worn away to a greater width, and the bluffs and cliffs again recede from the river, leaving a strip of flats along its banks. About two miles below Taylor's Falls another cañon is formed, called the Lower Dalles, but it lacks the wild rapids connected with the Upper Dalles.

To clamber over the rough rocks, to climb the steep ridges and the cliffs where practicable, to gather plants whose home is in such haunts, while enjoying the enchanting views, is delightful though wearisome work. One is also reminded that he is on ground somewhat classical for the botany of the upper Mississippi, since he is collecting in the footsteps of men who have honored names as pioneers in botanical exploration. Here Dr. Douglas Houghton collected plants in 1832, acting as surgeon and botanist to the expedition of Schoolcraft to the source of the Mississippi river. On its way home it explored the St. Croix, passing up this stream and crossing the narrow divide that separates it from the Brulé or Burntwood river, down which the party passed to Lake Superior. Some of the plants secured in this and the preceding expedition of 1831 are listed in the appendix to the narrative of the expedition to Itaska lake, and are credited to the St. Croix river. The late Dr. C. C. Parry, one of the members of Owen's Geological Survey, whose work included this region, collected here in 1848, and several of the plants given in the catalogue as a part of the report are from the St. Croix river, the Falls of the St. Croix taking their full share.

The time of visiting the Dalles was opportune in another respect, as it coincided with the occurrence of a log-jam for which this part of the St. Croix is noted. This had a botanical side, and furnished matters for reflection to one at all interested in the problem of forestry. To see the millions of feet of logs piled several deep in the river, and bridging it over a mile of its length, gave one a vivid idea of the rate of destruction at which the forests of pine along the upper St. Croix and its tributaries must be going on, in order to supply this material. And when this mass was added to the logs of numerous streams carrying their burdens to the Mississippi and the Great Lakes, and to the quantities of lumber transported by cars and water-craft, one could but ask in despair how long this can continue before the last stick is taken.

The forcing of the logs from their chaotic tangle by the skillful raftsmen looked like a perilous undertaking, but all passed off without serious accident. Many excursionists came from surrounding parts to see the jam, and watched the workmen with deep interest. The excitement of a spectator was at its height when a large section of the raft began to move, and the lumbermen hurried ashore to escape from the rush of logs coming down with resistless weight. There were heavy sounds of rubbing, and grinding and crushing, and if one of the smaller logs became fast in the rocks, or was caught and turned on end, it was quickly snapped in two. Again the huge raft crowded down from above and filled the space in the gorge vacated by the outgoing timbers, only to stop once more as it reached the sharp bend at the foot of the rapids, and the logs were wedged in between the cliffs. This operation was repeated several times, till the defile was cleared and the logs above ceased to come down in quantities sufficient to fill it. These were then loosened by degrees, and sent down in a safe number till the stream was cleared of obstructions after a work of a fortnight. As a witness of the jam and of the thousands of logs which, so to speak, passed in review, a deep impression was made upon my mind other than those due to its novel and exciting features. It represented a great waste of material from the point of view of true forestry and of the real lumber interests of the country. Multitudes of the logs cut for the mills were little more than poles, and far too many besides cut from trees too small and immature for the profit which a wise regard for the future would dictate. True it is claimed by lumbermen that it is best to cut all the merchantable trees from a tract they may be cutting over, because all that are left become a prey to fires rendered much more frequent and destructive by the dry remnants of trees. This may be a valid excuse under existing regulations; but it proves still more clearly the need of adequate forest management either by state or national government to check the waste from any cause.

There are features of more than usual botanical and geological interest to one working among the rocks of the St. Croix. The mass of the rocks is greenish, or grayish-green, and granular, porphyritic, or amygdaloidal in structure. Being unaware of the nature of the outcrop at the time of visiting the Dalles, their identity with those on the Keweenaw

Peninsula was at once recognized. Hand specimens of the two could hardly be distinguished from one another. They are such as bear the general designation of melaphyr, the diabase-porphyry of Irving.[1] It is evident to those studying the relations of plants and soil, that the materials arising from the decomposition of such rocks will to some extent affect the flora. The shaded cliffs, and crevices by which they are seamed and broken in many ways also afford a congenial home for numerous ferns. They were not only in great abundance, but also of fine development. They may be called the most characteristic features of the flora of the Dalles.

The most interesting fern I met with was *Aspidium fragrans* Swartz. Some fronds were nearly a foot long, exclusive of the chaffy stipe. Its pale or ashy color, its glandular pinnae, its balsamic fragrance, at once show that a fern quite different from the common kinds is in hand. It grows in the clefts of the rocks, preferring the shaded, vertical fissures, clinging to them where a foothold can be obtained. Dr. Parry first detected it here within the limits of the United States. He remarks of it in his Catalogue: "I am informed by Dr. Torrey that this species has never before been found in the United States, but has been obtained in British America and Kamtschatka. In the locality here specified it is quite abundant."[2] It is still abundant, at least on the Wisconsin side of the river, where most of the ferns collected were obtained. Since Parry's discovery of it here it has been found in several localities from northern New England westward, keeping well towards the British Provinces.

Woodsia obtusa Torr., is seen in similar situations, but is not so abundant. *Woodsia Ilvensis* R. Br., is one of the most frequent of the rock ferns, growing on their exposed faces in all localities. Wherever I have found it, and this has been in many localities from the Saguenay westward in the region of the St. Lawrence and the Great Lakes, it shows itself a plant capable of enduring the severest drouths. The fronds often look crisp and apparently dead, but quickly revive when moistened.

The delicate *Cystopteris fragilis* Bernh. was obtained from the shaded cliffs, and on the Minnesota side a few specimens more like the var. *dentata* Hooker were taken from similar places. Once I came across *Camptosorus rhizophyllus* Link. It covered a space of a few square feet on some detached rocks in a deep shady nook beside a pond. This may be where Parry found it, since he gives as its habitat.—"Shaded and detached rocks, Falls of St. Croix." It was my first sight of this fern in the West, though I have often looked for it in favorable localities. The rocks on which it grew were trappean. It is generally, but not exclusively, credited to calarceous rocks. The only place besides this where I have seen it was in Western New York, where it grew in shaded places along the shelves of cliffs of limestone. In that pleasant little book of Williamson, "Ferns of Kentucky," he says of it, "It is found in all our Kentucky woods wherever there are detached moss-covered boulders, on outcropping rocks and cliffs either limestone or sandstone."

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[1] The Copper-bearing Rocks of Lake Superior, by R. D. Irving.

[2] Owen's Report, p. 621.

Another rare or local plant was gathered from the rocks above the village of Taylor's Falls, *Talinum teretifolium* Pursh. Houghton found it here in 1832. It is occasionally met with from Pennsylvania westward to Minnesota in our northern flora, being more common in Minnesota than elsewhere in this range of states. The Manual accords it as a habitat, "serpentine rocks," a much too restricted one. They are not of that character here, being diabase, though chemically, if this be needful, some of the same elements and their compounds could be yielded on decomposition. Upham, in the Minnesota Catalogue, says of the plant, "Rare, occurring only on ledges of rock, (trap, syenite, granite and quartzite)." I have found it but once before, in the silicious sands at Miller's, Lake Co., Ind. In Illinois it is found in "sandy prairies and barrens," as stated in Patterson's "Catalogue of the Plants of Illinois." At Taylor's Falls three other plants accompanied it on the trappean rocks, which are also found with it at Miller's, Campanula rotundifolia, Selaginella rupestris, and Cladonia rangiferina. All these do well in the sand. It shows that the Talinum would be easy to cultivate. Its flowers are pretty, though expanding late in the day and lasting but a short time; but its cylindrical leaves give it an odd though interesting look. It does not rival in the abundance of its flowers its congener from Central America, *Talinum patens* Willd., cultivated for platbands and as a basket plant, but would excel it in being hardy in our latitude, and might be used in a similar way, as well as for rockwork. As Vilmorin says of T. patens, "It keeps fresh in spite of heat and drouth, and will grow vigorously on unshaded rocks."[1]

Not uncommon on the rocks were specimens of *Houstonia purpurea* L. var. *longifolia* Gray. The characteristics were intermediate, allying it more closely to the type than ordinary examples of the variety; the leaves being sometimes three-ribbed and somewhat tufted or rosulate near the root. Several stems usually grow from the same root. The only plants besides calling for notice are, Oxybaphus nyctagineus, seen occasionally on the rocky banks, and Gentiana alba in springy ground.

(Concluded next month.)

Englewood, Chicago.

BRIEFER ARTICLES.

A new Aster from California (with plate XI).—**Aster Orcuttii** Vasey & Rose, n. sp.—Stems suffruticose, somewhat branching, pearly white, glabrous: lower leaves obovate, 1 to 2 in. long, with cuneate base; upper ones often oblong, with broad sessile or somewhat clasping base, obtuse at tip, spinulose-toothed, glabrous: heads solitary and terminal on leafy branches, sessile or nearly so, very large, an inch or more in diameter: bracts of the involucre closely imbricated in 3 or 4 series, oblong with tapering green tips ciliate on the margins: rays an inch long, "lavender to delicate mauve color": disk-flowers 4 lines long, tapering toward the base: style branches broad: achenes densely long white villous: pappus coarse and scabrous.—Collected at "Cariso Creek Wash," Colorado Desert, California (where it is very abundant), April and November, by *C. R. Orcutt.*—This handsome flowered species, although it resembles in habit and leaf some species of Aplopappus, evidently belongs to Gray's section MEGALASTRUM under Aster, and near A. tortifolius. It differs from that species in its almost sessile head, different involucral bracts, obtuse leaves, and larger disk-flowers. Mr. Orcutt obtained seeds of it and considers it worthy of cultivation.—J. N. ROSE, *Department of Agriculture, Washington, D. C.*

A new Fomes from northern Montana. (With plate XII).—**Fomes Ellisianus** Anders., n. sp.:—On the living trunks and larger branches of Shepherdia argentea, valley of the Teton, opposite the "Three Knees," buttes of the Marias river, northern Montana, July 1889. *Anderson, no. 537.*

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[1] Les Fleurs de pleine Terre, p. 1124.

Pileus dimidiate, unguliform, 5 to 6 cm. thick, radiate-rugose and zonate; surface whitish and subpulverulent at first, becoming yellowish and glabrate, rimose, and finally of a dark, weather-beaten wood color; margin subobtuse or rounded, in the plane and concave specimens frequently with a distinct edge along its centre: pores stratose, sub-cylindrical, about three to a millimeter (including dissepiments), margins sub-acute, color at first white, finally creamy or faintly yellowish, fragile, easily bruised and rubbed off, leaving the surface ochraceous; surface concave, becoming plane or convex in age. Pores extending nearly through to the upper surface of the pileus, being covered above only by a thin (2–4 mm.) corky, pale-ochraceous layer. Spores hyaline, elliptical-globose or oblong, 5–6×4–5 μ.

In old specimens the annual layer of pores does not extend fully out, so that the margin of the pileus becomes broadly rounded, as described.

Related to *Fomes fraxinophilus* Peck, which species is thinner and broader, not rimose and with the pore walls thicker.

This fine species, Fomes Ellisianus, is very abundant in the Teton valley and doubtless throughout northern Montana and the northwest territory. Shepherdia argentea in these regions frequently grows in dense groves along streams and the fungus with its pileus the color of the host bark and pure white or creamy pore surface forms a striking and beautiful object. It is a pleasure to dedicate this species to Mr. J. B. Ellis, who has so generously helped me in my mycological work in Montana and elsewhere.—F. W. ANDERSON, *New York City*, Jan. 9th, 1891.

Silphium laciniatum L.—In the Botanic Garden of Harvard University two specimens of *Silphium laciniatum* L. have been cultivated for a number of years. Although these plants differ very noticeably in several particulars, Dr. Gray did not regard them as sufficiently distinct for separate systematic treatment. Sometime ago Dr. Watson kindly called my attention to the plants in question, and expressed the opinion that it would be well after all that they should be described, in the hope that botanists living where this well-known species occurs may observe whether or not these forms are constant enough to receive recognition as varieties. Acting upon this suggestion I have examined the plants and find they have the following distinctive characters:

NO. 1. Stem very rough, especially near the summit, where, together with peduncles and involucres, it is covered with bristly white jointed hairs, which are not at all glandular; leaves flat or nearly so, the upper cauline small, with narrow segments and inserted by a narrow clasping base; the stipular appendages, which are present on the middle cauline leaves, deeply laciniate; involucral bracts rather rigid, acute, erect or spreading, seldom reflexed.

No. 2. Stem, peduncles, involucres, and bracts densely covered with a very short brown glandular pubescence with only occasional white jointed hairs; leaves not flat but conspicuously curled or "crisped," the upper cauline larger and more numerous than in no. 1, sessile with very broad cordate clasping bases; stipular appendages of the others subentire or toothed, but not deeply laciniate; scales of the involucre long-acuminate, thinner than in no. 1, and nearly always abruptly reflexed. Blooms late in October, a month or more after the other. I have thus far been unable to detect any difference in the flowers, except that the rays of no. 2 are distinctly paler than no. 1.

Unfortunately it is not known from what localities the plants in the Harvard Garden were taken. On comparing them with the specimens in the Gray Herbarium, I find that the first is the more usual form; while only one specimen in the herbarium (from Lexington, Ky., collected by Short,) approaches nearly to no. 2.

It has long been recognized that S. laciniatum is subject to considerable variation in stem and foliage, and efforts have accordingly been made from time to time to separate as varieties or even distinct species some of the more remarkable forms of this polymorphic plant. In these attempts, however, the distinctions have been based chiefly upon such characters as the depth to which the leaves were divided, the paniculate or subspicate inflorescence, the presence of copious resin, etc., which have proved unsatisfactory for systematic purposes; since the division of the leaves, and character of the inflorescence are very variable, even in the same individual. It remains to be seen whether the characters here described will be found more serviceable. Most important among them, I think, is the nature of the pubescence, as there the difference is scarcely one of degree, but rather of kind.

As I hope to contiuue my study of the forms of S. laciniatum, I should be much indebted for specimens of, or facts concerning this widely distributed species. Information about the range of the glandular-stemmed variety (no. 2), or the possible occurrence of intermediate forms will be especially acceptable.— B. L. ROBINSON, *Cambridge, Mass.*, Dec. 1890.

The propagation of Ranunculus lacustris Beck & Tracy.—That little is positively known of the true length of time that this plant lives, is evidenced by the following quotations:

"Perennial by rooting from the nodes, if at all." (Gray's Manual, revised edition, under R. multifidus.)

"It probably lives about a year. The seedlings appear late in the autumn, along the banks and in the bottoms of dried up pools ready to make an early growth in the following spring." (Dr. C. E. Bessey, in American Naturalist, May, 1890.)

"On Staten Island, it certainly appears to be perennial." (Dr. N. L. Britton, in Bulletin of Torrey Botanical Club, July, 1890.)

My attention was attracted to the plant early in May, when I found it blooming in great profusion in this vicinity, many of the flowers being double. Its habitat, about Alma, is chiefly shallow ponds, made by the collection of surface water in slight depressions in the clayey soil of the region. These ponds are often dried up early in the summer in dry seasons, particularly since the forests have been cut off. During the latter part of May and throughout June, 1890, there was a long continued drought, so that by the middle of July, very many of these ponds were nearly or quite dry. About this time my interest in R. lacustris was renewed by the note in regard to it in the Bulletin of the Torrey Botanical Club for July, and I visited some of its favorite haunts to find out what its condition was at that season.

The date as recorded in my note-book was July 21st. The water of the pool was all gone, leaving a soft mud on the bottom and apparently no specimens of the plant alive. On closer examination, however, I found that the plants were there, but in a condition hardly recognizable. The floating stems were prostrate on the mud or partly buried in it, their finely dissected leaves dry and withered or entirely gone. The stems, however, were alive and green, and at the nodes were clusters of small leaves and budding rootlets. Even at this time there were many cases, in which parts of stems had disappeared and the new plants had established themselves. An interesting fact in this connection was the marked brittleness of the stems of the old plants — they broke very readily, so that it was hard to disentangle them from the mud and weeds without snapping them into bits. During the summer I visited the same and similar localities several times, and in a very little while after my first visit I found that all traces of old stems had disappeared, and that the young plants were making vigorous growth and might have been mistaken for seedlings. These plants rooted vigorously, sending out large clusters of threadlike fibrous roots and numerous petiolate three parted leaves, with cleft divisions. The petioles and under sides of the leaves were generally decidedly pubescent. Under the date, Sept. 15th, I find the following in my notes:

"These plants have continued to grow until, in many cases they are four or five inches in height, quite pubescent and in many places so crowded as to densely carpet the dry bed of the ponds in which they grow." I was unable to decide whether the young plants sent out runners as soon as they were well rooted, but there were some indications that such was the case, as they became densely crowded in places where apparently there were but few specimens in the beginning. If there were such runners they soon disappeared and the plants stopped sending them out. Two other possible explanations suggested themselves to me; one, that such part of the stems of the old plants as were well covered with mud retained their vitality much longer than those not so protected, and appeared like runners, as the surface of the mud became drier and shrunk away; the other, that part of these young plants were seedlings, but if they were such their growth was exceedingly rapid, for the plants in given clusters were very nearly of the same size. At the date given above, the axes of the plants had not increased materially in length. The leaves were practically all radical and because of the crowded condition of the plants, long petioled. Shortly after the middle of September the fall rains set in, and water began to collect again in the ponds. At this time the stems began to grow, at first with very short nodes, but later, as the water became deeper, with longer ones. The greater number of plants sent out branches from the nodes of the stem even when the internodes were short. As the water grew deeper during the fall, the leaves which were submerged died and new ones, more finely cut, replaced them, and by the time the plants were entirely covered the foliage was as finely dissected as that of the aquatic flowering form. On the 18th of October I found two plants in bloom. The water had hardly reached them and the stems were trailing with rootlets projecting from the underside of the nodes. The leaves of these specimens were petiolate and between the dissected form of the aquatic plant and the cleft and parted form characteristic of the terrestrial plants of the summer. The flowers were somewhat smaller than the usual aquatic ones. On my last visit made late in November, just as the ice was beginning to form, I found that the depth of water in the ponds had materially increased and that the submerged plants had made strong and rapid growth, and were entirely typical in foliage and other particulars. The summer leaves were all dead and brown, while the new ones were green and vigorous. Some plants which I had transplanted above high water mark, were still living, but showed no marked growth as in those under water, and the leaves were unchanged. From these considerations, if we consider the observed conditions of growth and propagation normal, and there is no evidence to the contrary, our plant is truly perennial, since the old stems live long enough to nourish and thoroughly establish the plantlets which develop at their nodes after the flowering season is over.—CHAS. A. DAVIS, *Alma College, Alma, Mich.*

Cornus Baileyi C. & E. in Oregon.—In the revision of Cornaceæ (Coulter and Evans), under the discussion of the relationship of *C. stolonifera* Michx., *C. pubescens* Nutt., and *C. Baileyi C. & E.*[1] the prediction was made that C. Baileyi might be found along the Pacific coast and its ranges, where it had descended from its already known habitat of British America, and that it would be confounded with C. pubescens. Such has since proved to be the case. In a package of plants recently received from Messrs. Drake & Dickson, Portland, Oregon, there was found an undoubted specimen of C. Baileyi from Castle Rock, Columbia River, Oregon, bearing the date June 1889 as to flowers, the fruit evidently being of later collection. As in the east, C. Baileyi has been confused with C. stolonifera on account of the presence of some appressed pubescence, so here it had been labeled C. pubescens, evidently on account of the rather loosely pubescent under surface of the leaves. But an examination with a lens showed the presence of both appressed and wooly pubescence, such as is found in C. Baileyi and not in either of the others. The stone in this specimen is nearly twice as broad as high, is prominently flattened, has the square-shouldered top of typical C. Baileyi, and has its rather deeply furrowed edge. This combination of characters can leave no doubt as to the occurrence of C. Baileyi on the west coast. It is highly probable that forms may be found not so well defined as this one, and the presence of all three of these nearly related species will give more or less trouble when approaching each other, yet the extreme forms should give no cause for difficulty in determination.—WALTER H. EVANS, *Indianapolis, Ind., Herbarium Eli Lilly & Co.*

NOTE.—A private letter from E. J. Hill, of Englewood, Ills., makes the following statements concerning C. Baileyi: "My first note on it was in Sept. 1875, and it was called C. stolonifera. But studying this lake shore shrub in other years it seemed C. sericea, but the fruit was not colored rightly. It was too ruddy a shrub for C. paniculata, and so has remained a source of doubt till your characterization appeared. Noticing them the other day (January) while taking a trip in the Pine Barrens, the color of the canes of the two contrast considerably. When the leaves are off, we get the color to the best advantage. Those of C. stolonifera are very bright red and glossy in winter, of a hue almost crimson, while those of C. Baileyi are duller, a little of the brick-red cast. I think one could be pretty sure of identity in the winter, from this character alone."

J. M. C.

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[1] Bot. Gazette, xv. pp. 38 and 88.

EDITORIAL.

THE UTILITARIAN side of botany is one that is not attractive to the majority of botanists, unless it be in that intensely personal way embodied in the retort of a Harvard professor when annoyed by the inconsiderate question of a visitor to whom he was showing an object under the microscope. "And what is the use of it all", said the visitor. "It brings me my bread and butter", was the quick reply. It is to be feared that there are botanists who would feel that the science was sufficiently recognized if a proper number of places with comfortable salaries attached were provided for deserving aspirants, who might retire from the distractions and contamination of the world and devote their lives to pure science without being prodded into giving a thought to any possible application of their results to the practical affairs of life. Such positions are never likely to be numerous. In the meantime the world is clamoring for chemists and electricians and representatives of other departments of science to stand as sureties that capital shall not be misdirected. The increasing variety and complexity of the requirements makes evident the necessity for a more complete knowledge of the principles involved, and thus a return road is open to original investigation. This not only means a readier recognition of the value of the science, but increased tolerance for its more abstruse phases that appear to have no present relation to commercial life.

MEDICINE WAS the first patron of botany, and in foreign countries is still one. The early botanists were physicians, and studied plants to discover their medical properties. The first botanic gardens were founded with this purpose in view. Afterward came the study and cultivation of plants brought together by travelers and explorers with the expectation of an increase of the natural productions upon which commerce thrives. This is especially marked in the maritime nations, such as England and France. It is the principal motive for the maintenance of the Royal Gardens at Kew. In America, neither of these interests have much affected the growth of the science. In fact, not until recently has botany been much called upon to lend material aid to the development of the western world. This time it is agriculture that lends a hand, and it has come largely through the establishment of the agricultural colleges, the agricultural experiment stations and the section of vegetable pathology in the Department of Agriculture at Washington. However, none of these gave the initiative to the present train of thought. It came from a visit to a large pharmaceutical establishment at Indianapolis, in which a professional botanist is employed, with facilities for doing good work both for his employers and for science. Why may we not hope that other and various kinds of commercial enterprises may find it profitable to make use of the services of well trained botanists? The science is not likely to lose anything by it, and there are possibilities of considerable gain.

CURRENT LITERATURE..

Minor Notices.

EDUCATION for March contains an article by Prof. Conway MacMillan in which the evils of the common three-months course in botany are vigorously exposed, as they have been many times before, and will need to be many times more. The theme is an inexhaustible one and the remedy proposed will be as polymorphous as the writers are nuerous. For example: in our judgment the remedy lies in the education of the teacher and not necessarily in the change of course.

BOOKS ON the diseases of plants are increasing. The third one in the English language has just been issued, and imitates its predecessors in form, size, and in its British origin. The work is by Dr. A. B. Griffiths,[1] and deals with the injuries to plants brought about by plant, animal and other agencies. A large number of plant affections are treated in a very brief manner, and in most instances a cure or preventive is given. Two drawbacks to the usefulness of the work are prominent: the inadequate accounts of the maladies, and the rather antiquated character of part of the information that is included. The author has made a praiseworthy attempt to provide (suggest does not seem to be the right word) remedies and preventives, but they are largely founded upon general principles, such as: destroy all infected plants, apply a solution of iron sulphate, topdress the land with gas-lime or quicklime. England is far behind the United States in the knowledge and use of specific remedies for plant ailments.

DR. ROLAND THAXTER has issued a supplementary note (Proc. Am. Acad. p. 261, presented Jan. 14, 1891) to his former paper on N. Am. *Laboulbeniaceæ*. The additions of a single season have been so unexpectedly large and important that it has been thought wise to defer the promised monograph. With the present additions, the species of this family in North America already outnumber all the known exotic species. A remarkable new genus *Zodiomyces*, is described, and forms a distinct departure in the group. *Hesperomyces* is another new genus; while *Peyritschiella* receives a new species, and *Laboulbenia* six.

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[1] GRIFFITHS, A. B.—The diseases of crops and their remedies: a handbook of economic biology for farmers and students. pp. 174. Illustrated. 12°. London: George Bell & Sons, 1890. 2s. 6d.

WE HAVE RECEIVED the advance sheets and plate proofs of Ellis & Everhart's North American Pyrenomycetes. The illustrations are all original, the drawing having been the work of Mr. F. W. Anderson. There are 41 plates, each one accompanied by a page of explanatory text. We understand that 4 more plates will be issued as a supplement. In looking over the plates it is evident that the volume will be a boon to American mycologists, and that this large and rapidly increasing group of botanists will warmly welcome its appearance.

OPEN LETTERS.

Mounting plants.

THOSE WHO have had experience in mounting plants for the herbarium will readily understand why Prof. Beal should "decidedly favor" fastening down grasses with gummed strips, for of all things grasses are the most refractory subjects to glue down, and unless the work is expertly done and the stout culms immediately stayed by strips (without waiting for these to "spring up" before being "patched up,") there is likely to be displayed all the defects and drawbacks which our friend specifies. But it has occurred to me that notwithstanding Prof. Beal expressly restricts his remarks to the "mounting of grasses and allied plants" there might be some who would construe them into a qualified condemnation of the glue process from beginning to end. This, I take it, was not intended. Excepting the grasses there is not another large order of plants which the writer, for one, would not much prefer glued down; the Compositæ, Leguminosæ, Rosaceæ, Umbelliferæ and even the Cyperaceæ. A delicate Astragalus or Vicia can be neatly and expeditiously mounted so that every flower and leaflet in contact with the sheet will be securely fastened and that, too, without showing a particle of "surplus glue" to mar the perfection of the work; the same may be said of all the Umbelliferæ, but more especially of those with finely dissected leaves; while as for the Compositæ they are so easily glued down, held so firmly, look so well after the work is done, are so convenient to handle and easy to study, I can not concieve of two opinions being entertained as to the preferable mode of mounting them. Were the objection that specimens "not mounted right side out" can not be turned over, really as formidable as it appears in the statement it would have long ago led to the abandonment of gluing down. As a matter of fact I do not recall, in thirty years' experience, having ever been balked by a specimen mounted wrong-side up. Nor does gluing prevent the detachment of small fragments for more careful examination with the aid of those capital helpers the cup of hot water and low power microscope. It is a poor and meager specimen, indeed, from which such little bits as are required for this purpose can not be taken without injury, but even this will be obviated when collectors learn to preserve surplus flowers, fruits, etc., for subsequent dissection.

Much has been said, one time and another, about the convenience of loose material for study, with the implication that mounted material was inconvenient just in proportion to the security of the attachment to the herbarium sheet. For my own part I avoid, as much as possible, handling loose specimens, and *for study* prefer things securely mounted. My mind is then relieved of any undercurrent of care lest labels or specimens get misplaced, I find open spaces left on the sheet for any sketches or analyses that I may care to make, and the identical fragment had under examination can be placed in a pocket alongside to attest the accuracy of the drawing. Notes can be written down and all this will remain while the sheet lasts as certainly appertaining to the very specimen made the subject of study. I can go so far as to mark with a little × the precise spot in head, spike, ament or what not, from which I detached my fragment for examination. For effecting such detachments with a minimum of injury to the specimen I use a tool painfully suggestive of a dentist's outfit, but really of more agreeable antecedents, a fine little chisel made by breaking off the hook of a steel crochet needle and then sharpening the end to a crosswise edge. The long handle gives a firm hold, the cutting edge is very narrow and with a steady thrust, under a lens, one may cut just the part desired without bringing away, unintentionally, ten times more than is wanted. —M. S. BEBB, *Rockford, Ills.*

NOTES AND NEWS.

REV. FRANCIS WOLLE'S "Diatomaceæ of North America" has just been issued. It contains 2300 figures and 112 plates.

IN THE *Public Ledger* (Feb. 19) of Philadelphia Mr. Thos. Meehan has published a long and interesting account of Rafieesque.

IN THE article of Dr. Homer Bowers on Hydrastis Canadensis, which appeared in the March number, the following corrections should be made: p. 76, 9th line from bottom, "inclines" should read "inclined"; p. 77, last line, erase "not." This last is naturally a very important correction.

UNDER LEAVE of absence from the University of Wisconsin Prof. Chas. R. Barnes will spend the time from April to September at Cambridge as assistant in the Gray Herbarium. It is the intention of the director, Dr. Sereno Watson, to have the important bryological collections rendered available to students as soon as possible. The initiation of this work together with the revision of the Field, Forest and Garden botany which is in progress, will occupy Prof. Barnes' time. Correspondents will please note the change of address.

b
a
W. Scholl. del.

ROSE on ASTER.

F. W. ANDERSON, ad nat. del.

ANDERSON on FOMES.

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VOL. XVI. MAY, 1891. NO. 5.

THE BOTANICAL GAZETTE

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[ISSUED MAY 16.]

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PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

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VOL. XVI. NO. 5.—BOTANICAL GAZETTE.—MAY, 1891.

On raised peat-bogs in New Brunswick.

W. F. GANONG.

In certain places near the sea-coast of Charlotte and St. John counties in the Province of New Brunswick there occur several large peat bogs, composed of the purest Sphagnum, which have their centers raised many feet above their margins. Such raised bogs must be exceedingly rare; indeed, Professor W. G. Farlow tells me that he has heard of but one other instance, which was in the case of a raised bog in Sweden described in a botanical journal some years ago. These in New Brunswick then must have a special botanical interest.

These bogs having come of late locally into notice for reasons to be referred to below, the present writer, who like many another botanist enjoys in his native place a reputation for omniscience in matters botanical, was called upon last summer to explain their origin. Not being able to do so, he found his natural and securest refuge in the usual resort in such cases, an habitual expression of scepticism (in this case nearly as much real as assumed) as to their very existence. All such refuge, however, was closed to him when, in August last, he, that is to say I, made a visit to one of them in company with a well-known enthusiast on peat bogs and skilful exponent of other local wonders, Mr. C. E. Boardman, of Milltown, New Brunswick.

The one we visited was near Seely's Cove, in Charlotte county, N. B., some twenty miles in an air line N. E. from Eastport, Maine. This bog lies on the right of the highway as one approaches the coast, and is over a quarter, perhaps half a mile in length. It is relatively narrow, being not more than one-sixth of that distance in breadth, perhaps less. It lies in a general N. and S. direction, nearly parallel, at its upper part at least, with the highway road, and therefore with the high land. It rises gently from the margin all around until it attains a height of about ten feet, when it slopes still more gently, probably four or five feet higher, and then becomes flat topped, and so runs for the above mentioned length. Its section would present about the curve of a loosely strung bow which bends rather abruptly toward the ends. Its surface is entirely naked and clear of trees and shrubs of any kind with the sole exception of an occasional very much dwarfed blueberry bush; and according to local tradition it has always been so. The same authority, it may be added in passing, says that it is growing in height; basing the statement upon the observation that teams and people at the lower end, which could formerly be seen from the upper, cannot now be so seen, a point not likely to escape notice in a sparsely-settled district where the doings of one's neighbors are of so much moment.

The bog is composed of nearly pure Sphagnum of the finest kind, free from all roots and similar impurities and showing not a trace of decay or anything resembling muck. Some few other mosses and lichens occur on the surface, but appear to form no part of the material below. The living material above merges gradually downwards into a clear, odorless, carbonaceous, semi-peat like material, which has been found to have important economic properties dependent upon those qualities. It is soaked with an abundance of water, clear and cold, and hence totally unlike ordinary bog-water. Its clearness was plain to the eye as it flowed from a squeezed handful of the moss, its coldness to the senses, both by its feeling when a hand was thrust into it, and also by the satisfactorily refrigerated condition of the liquid portion of our luncheon which was buried in it for a time to await our return. The bog does not tremble under foot. It is bounded on one side only by high land, and on the other it slopes down and merges into a flat bog of the ordinary kind which is of great extent. The latter presents all the ordinary bog characters, dirty water, muck, trembling places, and a growth of clumps of small spruces and the ordinary ericaceous shrubs; in fact it is the common every-day bog we all know. It is a novel and pleasing experience to walk from the dirty quaking affair up a slope to one so clean and compact.

My guide, with his veracity fully vindicated, was of course triumphant, and he gave me many details as to others, the principal of which he has had the kindness to repeat in a letter. His business during the past two years has taken him over every part of this section of the country; and as he has been specially on the look-out for the bogs, his observations are valuable. In all he knows of sixteen bogs of considerable size, of this raised character, the areas of which vary from a few up to three hundred acres, the total acreage of all sixteen being estimated at about eleven hundred acres. They vary in height from a few feet up to as much as forty or fifty. They are all comprised within a limit of about thirty miles, between L'Etang Harbor and Musquash; and although a careful search has been made for others in other parts of New Brunswick and in Maine, none has been discovered. They are all near the coast, with only two or three exceptions being within two or three miles of the salt water, only one of them being as far as four miles away. Very few of them have any level bog portion. They are all entirely clear of trees or bushes, and composed of clear, clean Sphagnum. In one or two cases Mr. Boardman has bored to the bottom of the smaller ones and found them underlaid by clean gravel; in other cases the boring apparatus, adapted to go down twelve feet, did not reach bottom, and it brought up in all cases only close clean carbonized peat-moss, with no trace of muck. At Musquash one of the largest, though not a very high bog, is being extensively worked for the moss, which has been found exceedingly valuable as a bedding for horses and cattle. The workings have there gone to a depth of forty-four feet without finding bottom or muck impurities. The great purity, freedom from decay, antiseptic and absorbent powers of the carbonized moss promise to create a local industry of much importance; and practical men are there putting energy and capital into mining and experimenting with it.

Lest my readers, habituated to the appendage of a theory to all statements of facts, should experience a shock by its absence, I hasten to be in the fashion and offer my "theory" of their origin. I can speak personally only of the Seely's Cove bog, but possibly what is true of it may apply to others also. I think its origin and growth are connected with the great prevalence in this region of large, clear, cold springs. In fact there occur a few miles away single springs which are large enough to give origin to large brooks, and the water is invariably very cold and clear. A most famous spring of this character occurs on the line of railway a few miles from St. George and smaller ones are abundant everywhere. The purest water I ever saw, even in New Brunswick, where so many streams are crystal-clear, was in a spring brook within a mile or two of this bog. Now it is noticeable that the upper end of the bog comes in contact with the high land, and that it is for some distance parallel with it, that it is long and relatively narrow, and that on the side away from the higher land it sinks down to a large bog of the flat kind. I think it extremely probable that a huge cold spring (or a line of them) comes out from the high land at the upper end of the bog, and the water then flows along toward its lower end on the bottom, being soaked up as it goes. The bog then grows and carries up the water sponge-like with it, and when off to one side the influence of the spring diminishes and is finally lost, the ordinary bog conditions begin to prevail. All this is confirmed by the fact of which Mr. Boardman assures me, that there flows out from its lower end a brook of clear, cool water, large enough so that in times past it has turned the wheel of a mill. Water of this character does not flow from common bogs and a spring origin seems necessary to account for it.

One other point remains to be explained. Why are they treeless and shrubless? This I believe to be due to the coldness of the water supplied by the springs. The temperature is too low for the growth of the roots of shrubs or trees. Its coldness has been already referred to; even at a depth of but a few inches this was very marked. It is perhaps, too, a point of importance that the bog bears in greatest profusion the cloud-berry, *Rubus Chamæmorus;* so abundant is it that the inhabitants resort to the bog with pails and gather it in great quantities. This northern plant finds so congenial a home but rarely in these latitudes, and seems to point to the cold conditions prevailing in the bog. I advance this explanation but tentatively. Perhaps some of our botanists who take their outing in that favored region will give it their attention.

Harvard University, Cambridge, Mass.

Notes on the flora of the St. Croix region.

E. J. HILL.

(Concluded from p. 113.)

The rest of the time in the St. Croix region was given to the Chesago Lakes, situated a few miles west of Taylor's Falls. Three days of the early part of September were mainly devoted to an examination of the water-plants, or to those of the immediate shore. The body of water designated as above, or more often in the singular number, is made up of three principal sheets of water joined by narrow straits, and with numerous small bays indenting from its shores. On a tongue of land projecting from its eastern side is the village of Center City, the county seat of Chesago county, ambitious in name but diminutive. This was my stopping place, in the midst of a population almost wholly Swedish. There were fine farms around, and the many goodly farm buildings showed thrift and comfort. When one strolled into the fields and woods, there was a strong reminder of Ohio and New York in its better cultivated parts, though the hills were lower, and the beech, the chestnut and the tulip-tree were noticeably absent from the woodlands. But most of the other trees were there, the maple in abundance; and all the humbler plants, the asters, and goldenrods in the corners of the crooked fences, and those spared by the sheep and cattle feeding in the woods, had a familiar look.

The lakes and ponds abounded in species of *Potamogeton.* The shallower and more sheltered parts were covered with pond-lily plants, Nymphaea reniformis and Nuphar advena. Allusion has been made in a former article to the quantities of *P. Robbinsii* here. It almost filled the water in some places to the exclusion of other plants. The season was late for good specimens in fruit, as most of it had fallen off, but some was obtained in good condition. *P. prælongus* was also very abundant in deeper water, taking other areas quite to itself. So it may be said of *P. perfoliatus*, var. *lanceolatus*, and *P. pectinatus*, in places most suitable to their growth. Along the west side of a long point of land extending south from the railway station, *P. Spirillus* was sparingly found. I had not before seen it at the West, where it seems rare and local. One more station has been given for it in Minnesota, Prof. L. H. Bailey having found it in Long Lake, in the extreme northeastern part of the state, in 1886. I have not met with it in Michigan. Wheeler and Smith in their Catalogue of Michigan Plants credit it to the Upper Peninsula on the authority of Gray's Manual, the entry being "Lake Superior." But this is very general, and may be outside of Michigan, though there is no reason to question its presence in that state, except its rarity and the indefiniteness of the locality. Dr. Vasey has found it in northern Illinois, in McHenry county. This and the two stations for Minnesota are the only ones concerning which I have definite information for the Upper Mississippi and the Upper Lakes within the bounds of the United States. P. Spirillus is a common plant in some of the small lakes of western New York. Those I have seen there were generally furnished with well developed floating leaves. In the few specimens seen in Chesago Lake, the floating leaves were rare, the plants being almost always entirely submersed. It probably occurs in other parts of the lake, but time was lacking for a thorough search. My experience shows that the habitat assigned to this plant in Gray's Manual is too exclusive in character. I have heretofore found it in small lakes, not in streams. It grows along the shallow margins of these lakes, taking the shelving beach from where the water is about a foot and a half in depth to where it shallows to three or four inches. In the latter situations it may be left bare of water for a time when the winds blow off shore. Under such conditions it grows in tuft-like masses, with short and very leafy stems, being little more than a bunch of leaves.

Some of the plants of the shore were of considerable interest. *Sagittaria heterophylla* Pursh bore stamens the length of whose filaments allied it to the section containing S. variabilis more than to that containing S. heterophylla. They were two or three times as long as the anthers, but had a lance-ovate, very glandular base. Some of the leaves were sagittate with narrow appendages. The beaks of the fruit were turned to one side, and could hardly be called erect. *Juncus pelocarpus* E. Meyer grew in the wet sands of the shore. *Cyperus Engelmanni* Steud. had spikelets considerably flattened, or quite far from terete. *Hemicarpha subsquarrosa* Nees, generally but an inch or two high, was abundant in some places. Its scales were barely recurved at the point. Nearly all of the culms bore one or two small additional involucral leaves.

The most interesting plant of the wet shores was *Scirpus debilis* Pursh. Its flowers were uniformly characterized by two stamens, no exceptions being found as far as they were examined, and this extended far enough to establish the fact as a rule. The style was two-cleft, and all the bristles usually longer than the achenium. This was somewhat plano-convex, broadly obovate, thick, rugulose, shining, from dark brown to black in color. The stems were convex on one side and grooved on the other, a cross section being meniscoidal rather than grooved-triangular when the stems are fresh. It was exceptional to find the involucral leaf horizontal at maturity. The stems grew in quite large tufts, much like Eleocharis obtusa in habit. They were from six to fifteen inches long, frequently recurved or prostrate. Though variant from the species as described, it hardly seems separable from the type, as the number of stamens either in Scirpus or Eleocharis is not constant. The present season (1890) I have found essentially the same form in two places near Chicago, at Millers and Dune Park, Ind., in the Pine Barren region. These are stations on the Michigan Southern R.R., about five miles apart, and the plants were obtained from the wet sands of the ditches skirting the railway. Considerable pains were taken to see if the flowers had more than two stamens. A dozen clusters of spikelets were selected, generally from stems borne on different roots, and three or four flowers from each cluster were examined. The style proved uniformly two-cleft, and the stamens two in number. I looked in vain for an exception, but would not affirm that it may not be found. This seemed the more curious, because in 1877 I collected S. debilis of the typical form only a few rods from where it was found this year at Miller's. It was along a roadway in a field beside the railroad. It was sought again in the same locality, but in vain, the grass having supplanted it, or the grazing cattle having destroyed it. An examination of the dried specimens shows that they have flowers with three stamens. It is doubtful whether the two sets of gatherings from these contiguous spots on different years are of the same group, for this constancy of difference would hardly be expected. But those of 1890, though much farther apart, are referable to the same group, since they are from the ditch along the same side of the track, though this is not continuous, being crossed or interrupted by some low ridges. But plants readily spread under such conditions. In other respects the plants were quite like those from Chesago Lake.

In the wet sands near the station at Center City *Ranunculus Flammula* L. was frequent. The stems are ascending or erect, from three to five inches high. The lower leaves are linear to oblong-linear, and from one to two inches long. The flowers are from one-fourth to one-third of an inch in diameter, with five to seven petals. This is the second time

I have come across this form of the plant, having previously seen it under similar conditions of growth at Escanaba, Mich. Upham gives Minneapolis as another station for it in the state. Its range in Gray's Manual is given as "shore of Lake Ontario, and northward." As the Manual is for the United States I suppose this means the southern shore. Macoun gives it for the Canadian shore, and "the gravelly banks of rivers to lat. 69° (*Richardson.*)" The Michigan and Minnesota plants are interesting as extending the geographical range farther up the Great Lakes and into the region of the Upper Mississippi. The plant evidently conforms to the var. *intermedius* in the Manual. The conditions of growth may have something to do with the erect or semi-erect habit of the stems. In both cases where found these were carefully noted and compared with those of var. *reptans*, the common form. I have always found the latter in open places, in sand or gravel quite bare of other vegetation, or with plants low or creeping like itself, and not shading it. In the var. *intermedius* the plants grew among scattered spears of grass and rushes, considerably overtopping and shading them. It could not easily lie on the ground and root at the joints, though there is sometimes a tendency to this in the lowest joint or two. The erect or ascending stems—the latter the more common position—are so slender that they could hardly support themselves if deprived of the shelter and protection of the surrounding plants, and forced into the conditions of the creeping stemmed variety. They often lean against these plants as if too weak to stand alone, and are apparently struggling upward toward the light.

Englewood, Chicago.

A visit to the West Indies.

A. S. HITCHCOCK.

The readers of the GAZETTE may be interested in a few of the observations made during a recent trip to the West Indies.

The expedition was organized and conducted by Dr. J. T. Rothrock, of the University of Pennsylvania, in whose yacht, the White Cap, we lived during our absence from the United States. We started from Fernandina, Florida, Nov. 4th, 1890, and returned to the same port Jan. 29th, 1891. Our vessel, a yawl-rigged schooner of fifty-one tons, was commanded by Capt. Freeman Boynton, an experienced navigator in the West Indian region. The party consisted of Dr. Rothrock, D. J. Bullock and J. P. Moore, of Philadelphia, and the writer.

The month of November was spent cruising through the Bahamas of which group we visited New Providence, Eleuthera, Cat Island, Watlings, Crooked Island, Fortune Island and Great Inagua.

Excepting Inagua the islands are quite similar in geological and floral characters. Over the coral limestone are scattered thin patches of soil which have collected in the depressions, the larger and deeper of which are termed banana holes. It was surprising to see so much vegetation growing from so little soil. But the ligneous flora consists mostly of shrubs, eight or ten feet high, while trees of even moderate height are uncommon, although Andros is said to be thickly wooded.

The land owners are at present greatly interested in the cultivation of Sisal hemp,[1] the fiber of which promises to become an important production of the islands. The plant is admirably adapted to thrive on the almost soilless rock, where few other economic plants would grow. When a plantation is once established successive crops are taken from the same plants.

The pine apple[2] is cultivated more or less throughout the islands but chiefly on Eleuthera, where the peculiar red soil, which is best fitted to produce the finest fruit, is found in greater abundance. No fertilizer had been used, and the growers found that the soil, strangely enough, was wearing out, with no virgin soil to draw upon. This result will come about in time, even in a tropical country, especially where the soil is thin. But now a chemical fertilizer is imported from the United States and the land is yielding large returns.

The cocoa-nut[3] is cultivated everywhere especially near the sea-shore, where it finds the best conditions for its growth. The milk of the nut is very refreshing to a thirsty traveler. Many a time, on a hot day, when oppressed by the heat, I have made my way into a plantation, found a tree where the nuts were within reach, cut one off and with my machete, slashed away a portion of the thick husk surrounding the nut, made an opening through the shell, and quaffed the cool and pleasant flavored liquid within. The green cocoa-nut contains only milk, but as it ripens the "meat" deposits around the interior, at first soft and nearly tasteless, but finally hard and sweet as in the nut of our markets. While the meat is yet soft it is much relished by some, but to me it was insipid.

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[1] Agave rigida Mill. var. Sisalana Engelm. Acad. St. Louis, iii. p. 316. (For article on the industry, see Northrop, Pop. Sci. Mo. Mar. 1891.) The names following are those used in Grisebach's Flora of the British West Indies.

[2] Ananassa sativa. (Bromel.)

[3] Cocos nucifera. (Palm.)

At Crooked Island we saw the French wells, which are cut in the solid rock scarcely above the sea level, and some half buried cannon both of which are supposed to date back to the time of the buccaneers. Along the shores we saw innumerable piles of conch shells, each with a small hole broken in the end, where the conch had been pushed from its fastening by the fishermen. The flesh, which to me tasted like boiled leather, is much esteemed by the natives.

The southern islands of the group yield large quantities of salt. Sea-water is run into shallow ponds, each owner having his portion partitioned off by a stone wall, where it is evaporated by the sun. The residue is scraped into large heaps near by, where it is allowed to remain exposed to the sun and rain, apparently without serious loss.

Inagua differs somewhat from the other islands of the group. It is larger, more nearly circular in outline, and has a deeper covering of soil. There is a more decided change in the flora, Florida types being replaced by those of Cuba and Hayti. Grass land is comparatively abundant, affording pasturage for stock. In the interior of the island are savannas which appear to be dried up salt marshes. The experience acquired during a trip to this region will furnish our party with ample material for mosquito stories during the rest of their lives. The little pests were simply intolerable. As we walked along they flew up in clouds from the grass, biting through our clothes and even crawling up our sleeves for a good drink of our rich northern blood. No doubt the recording angel, that day, was obliged to devote considerable attention to Inagua. I tried smearing the exposed parts with oil of pennyroyal and vaseline, as has been recommended, but it was of little avail against Inagua mosquitoes. On the other hand, while in Jamaica we were not troubled by insect pests of any kind, except, in certain localities, by the ticks.

Nor were we nearly so uncomfortable from the heat, as in the Bahamas.

The trees in common cultivation through the Bahamas are poinciana,[4] with its long pendent pods and feathery foliage, which is deciduous in January; the almond,[5] easily distinguished at long distances by its flat-topped, imbricated foliage; "cedar",[6] sand-box,[7] and, of course, the cocoa-nut and banana.[8] The silk-cotton tree,[9] or "big tree" as the inhabitants have christened it, near the post office at Nassau, figured in Garden and Forest (vol. iii. p. 347), is a magnificent specimen, but is peculiar in being low and wide-spreading instead of tall and proportionately more slender as is usually the case. In Jamaica it is one of the tallest trees of the forest, sometimes rising a hundred feet to the first branch. It is used extensively for making canoes, which are hollowed out from a single log, but is of little value otherwise.

The silver-top palmetto[10] occurs abundantly throughout the Bahamas. It is used by the natives for thatching their huts; and also for making hats, mats, baskets, ropes, etc., for which purpose the central unexpanded bunch of leaves is employed.

After leaving Inagua, we sailed for Kingston, Jamaica. During our six weeks stay on this beautiful island we visited, after leaving the capital, Port Morant, Port Antonio and
e/ Luc~~c~~a. The party made a most delightful trip to the summit of Blue Mountain Peak, distant from Kingston twenty-one miles. The journey to Gordantown, about half way, was made in carriages, the remainder on horseback, our provisions and apparatus being carried on pack mules. Although midwinter, flowers were abundant, as were ripe strawberries, which we picked and ate with relish. Above 5,000 feet, approximately, tree-ferns[11] appeared and gave a decided tropical look to the forest. Blue Mountain Peak reaches an altitude of about 7,300 feet, the highest point on the island. The temperature at noon was 55° F., but it is said that ice occasionally forms. From 2,000 to 4,000 feet elevation coffee and

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[4] Poinciana regia. (Legum.)

[5] Terminalia Catappa. (Combret.)

[6] Casuarina equisetifolia. (Ament.)

[7] Hura crepitans. (Euphorb.)

[8] Musa sapientum. (Musac.)

[9] Eriodendron anfractuosum. (Bombac.)

[10] Thrinax argentea. (Palm.)

[11] Cyathea arborea. (Filic.)

cinchona plantations are frequently seen. We saw several more or less ruined drying-floors which were formerly used for drying the coffee. These were made by paving or cementing a square of level ground in a sunny situation.

As has been noted by most travelers in tropical regions the most striking feature of the vegetation to a person coming from the north, is the varied character of the flora. One rarely sees areas in which one species is conspicuously predominant. No one type is able to exclude others by force of numbers as in temperate climates. Another effect is the extension of the flowering season of a given species. There is to be sure, a season during which most of the flowers are produced, but one is almost sure to find stragglers in bloom at all times of the year.

Compared with the central United States, we find in Jamaica several exotic orders largely represented, as Malpighiaceae, Melastomaceae, Myrtaceae, and Piperaceae. Others of which we have but a few outlying members are there in abundance; as, Apocynaceae, Acanthaceae, Rubiaceae, Laurineae, Aroideae and the genera Solanum, Ipomoea and Croton. One cannot fail to observe also the more familiar orders Malvaceae. Leguminosae, especially Cassia and Mimosa, and a great variety of ferns. Ferns in the swamps; ferns on the arid rocks; ferns that are epiphytes; ferns that are climbing, either on trees by rootlets, or over bushes ~~or~~ by recurved spines; ferns of all sizes and shapes from the great tree ferns with fronds ten feet in length down to the wee species, an inch long, growing in the moss on its trunk. Aroideae will also attract attention, especially large leaved Philodendrons, climbing the tallest trees, and sending down long air-roots, which hang suspended like ropes, in fact they are used by the natives instead of ropes. The innocent looking Canna-like, but much dreaded, dumb cane[12] is another interesting member of the order.

Orchids are abundant, especially the epiphytic species. To see great bunches of these, many kinds in full flower, and the assortment of Tillandsias, or wild pines perched all along the branches of a half dead mango or silk-cotton tree, is a beautiful and, to the collector, usually a tantalizing sight.

On the other hand many orders, large at home, are scarcely represented in Jamaica; as, Ranunculaceae, Cruciferae, Caryophylleae, Rosaceae, Umbelliferae and the genus Carex.

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[12] Dieffenbachia Seguine. (Aroid.)

Even composites are scarce. Of Cacteae I observed *Opuntia Tuna* common along the coast; *O. coccinellifera* and *O. Ficus-indica*, introduced around dwellings, *Melocactus communis*, in arid places; *Cereus grandiflorus* and one or two other trailing or climbing *Cerei; C. Swartzii* and *Opuntia spinosissima*. The last two species were particularly abundant on the palisades, an extremely sandy tongue of land, at the end of which is Port Royal. *O. spinosissima* sometimes grows to the height of 25 feet and is truly a tree cactus, the straight and frightfully spiny trunk being crowned by a spreading or pendent series of oblong joints. C. Swartzii (botanically so called in Jamaica) also grows to the height of 25 or 30 feet and has the habit of C. gigantea. It is used extensively for hedges, being planted very close and kept trimmed to a given height. Another hedge plant much used is the Pinguin.[13]

Euphorbia antiquorum is introduced in many places, especially in the Bahamas, and where established, often occupies considerable area to the exclusion of everything else, forming a prickly and impenetrable thicket ten or fifteen feet in height.

On Eleuthera and some of the neighboring islands grows a species of *Agave*, with the flower stalk 25 or 30 feet high. This is, curiously enough, called "bamboo" by the natives.

The real bamboo is extensively naturalized in Jamaica, and is used for a variety of purposes. Many of the huts are made by weaving the split bamboos into upright posts and thatched with "cane" (sugar cane) or wild cane.[14] Baskets and other small articles are made from the finely split culms; drinking cups and other vessels from the closed joints; fences, including the posts, are largely made from this grass.

To me one of the greatest curiosities of the flora was the mangrove[15] swamps. These have been frequently described but must be seen to be appreciated. We saw a very fine grove at Port Morant, at the head of the bay and lining each side of a small river which enters it at that point. From the outside it presented a most beautiful bank of glossy, dark-green leaves, reaching to the water's edge. Inside, however, one sees about as dismal a view as can be imagined. The trees all perched on spider legs, through whose intricacies a man could scarcely make his way ten feet, the absence of life, except the devilish looking crabs, crawling around on the roots, the stillness, and often the vile odor of rotten oysters, all combine to make a mangrove swamp, though fascinating, a place to be left as soon as possible, and I always felt, on leaving as if I were being chased by all sorts of bacterial germs. In some places land is being reclaimed from the sea quite rapidly by these swamps. The trees live only in salt water and die off as soon as the land is dry. Thus the inner edge of a swamp is composed of dead or dying trunks or loop like roots, while the outer edge is constantly pushing out into the water as soil is gradually accumulated by the roots. This extension seaward is carried on first by means of the aerial roots which either spring from the arched roots, in which case they curve outward and downward, or from the branches, when they drop nearly vertically. These frequently branch and re-branch before reaching the mud in which they become fastened.

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[13] Bromelia Pinguin. (Bromel.)

[14] Arundo sp. (Gram.)

[15] Rhizophora Mangle. (Rhizoph.)

The second method is by means of the young plantlet, whose radicle elongates considerably before dropping from the tree, so that it is all ready to start out in life as soon as released. It is 8 or 10 inches long and cigar-shaped, thus placing the center of gravity near the lower end. In this condition it is carried in the water till the lower end strikes the mud, when roots are sent down, the leaves are developed and a young mangrove is started.

Along the seashore one sees an abundance of the seaside grape,[16] named from the likeness of the clusters of fruit to our cultivated Vitis and not from habit, for it is a straggling shrub or tree with large, round, smooth and unusually red-veined leaves.

Another common plant of the lowlands and one which the collector is likely to remember with regret is the necker-bean.[17] This is a more or less climbing shrub, having the stem, petioles and even the under side of the midribs armed with recurved prickles and bearing clusters of spiny pods which contain about two drab seeds of the size of marbles. The hand is easily introduced to gather the flowers, but the withdrawal is resisted by dozens of prickles — like a patent rat-trap.

In swampy places one usually finds the familiar Job's tears[18] with which baskets and other ornamental articles are made. At first sight one would hardly think that the hard bean-like seeds belonged to a grass.

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[16] Cocoloba uvifera. (Polygon.)

[17] Guilandina Bonducella. (Legum.)

[18] Coix lachryma. (Gram.)

In the forest we saw many trees whose names were familiar. Among them was the mahogany,[19] a majestic tree with globular woody fruit and abruptly pinnate leaves; and the logwood,[20] a small, leguminous tree, bearing at that season an abundance of flowers and fruit, and extensively naturalized in Jamaica. Large quantities of its wood and also of fustic[21] are exported for extracting the dye. As it is very bulky it would seem more economical to extract the dye on the island.

The trumpet tree,[22] rather common and quite conspicuous from its large leaves whitened beneath and clustered at the ends of the long branches, is quite useful on account of the fiber obtained from the inner bark. Out of this is made a very durable cordage; also whips by peeling back the bark, cutting off the inner wood except enough for a handle, and plaiting the fiber into a lash.

In the dense woods grows the cacoon,[23] a high-climbing leguminous vine bearing an immense pod as much as three or four feet long which contains the large sea-beans often washed up by the sea on sandy beaches.

Many woody climbers in their youth entwine various trees, but these in time are strangled to death and rot away leaving the ungrateful vines as huge spirals, capable of bearing their own weight, having destroyed the ladders by which they mounted to their success.

ll I now mention a few of the more important fruits. Of the Anonaceæ there are the sugar apple,[24] about the size of an orange and green, the one-seeded carpids composing it being easily separated from each other; the custard apple[25] of about the same size but with the surface smooth and light brown; the sour sap,[26] larger, ovoid with the green surface weak-prickly; and the cherimoya[27] (Jeremiah, as the natives pronounce it), about the size of the foregoing, but with the surface smooth and faceted. This last is certainly the most delicious fruit I ever tasted. We saw it only on Blue Mountain. The sour sap is acid and at first seemed to have the flavor of kerosene, but we soon became accustomed to it and when beaten up with sugar it was quite a delicacy.

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[19] Swietenia Mahogoni. (Meliac.)
[20] Haematoxylon Campechianum. (Legum.)
[21] Maclura tinctoria. (Urtic.)
[22] Cecropia peltata. (Urtic.)
[23] Entada scandens. (Legum.)
[24] Rollinia Sieberi.
[25] Anona reticulata.
[26] Anona squamosa.
[27] Anona Cherimolia.

The papaw,[28] a smooth yellow fruit, of one to three or even ten pounds weight, containing the numerous shot-like seeds in the center, tastes not unlike muskmelon. The guava,[29] from which the delicious guava jelly is made, is about the size of a lime, and like the pomegranate, contains so many seeds that it is not desirable eating though pleasant flavored.

The naseberry,[30] or sapodilla as it is called in the Bahamas and to some extent in Kingston, is also about the size of a lime, but has a rough brown skin and one or two large black seeds.

The alligator pear[31] was a grievous disappointment. It is about the size of a goose egg and contains one large seed surrounded by yellow, and to us very insipid, flesh. It was learned that it should be flavored with salt, pepper, vinegar, curry ~~savory~~, etc., when its insipidity would be overcome.

The mango,[32] in spite of its slight turpentine flavor, was very good eating, but it requires considerable experience to eat it without daubing the juice all over the face. The fruit is somewhat larger than the alligator pear and flattened. It contains a large seed, whose surface is covered with long fiber, out of which the pulp must be sucked.

Oranges, and sweet ones, too, are plenty. We bought them at fifty cents per hundred. Bananas are also abundant, but strange to say, we found great difficulty in getting ripe ones, as they are picked for shipment when green. They sell for twenty-five cents a bunch. Plantains[33] resemble bananas but can be distinguished by the longer neck to the fruit. They are eaten fried in cocoanut oil or butter, being while raw very inferior to bananas.

The akee[34] is a red, pear-shaped or slightly three-sided fruit, which contains a pulp (arillus) of the color and consistency of beef-fat. At maturity it bursts open, exposing the large, glossy black seeds. It is used to flavor fish.

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[28] Carica Papaya. (Papayac.)
[29] Psidium Guava. (Myrtac.)
[30] Sapota achras. (Sapotac.)
[31] Persea gratissima. (Laurin.)
[32] Mangifera Indica. (Terebinth.)
[33] Musa paradisiaca. (Musac.)
[34] Blighia sapida. (Sapind.)

There are several starch-containing food plants which are little seen in the north. The yam[35] probably furnishes more food in Jamaica than any other plants grown. It seemed inferior to either the sweet potato or the Irish potato, being coarser and rather tasteless. The tuberous roots are large, irregular, and frequently weigh several pounds.

The cassava[36] (tapioca, mandioca) also furnishes a large amount of food to the poorer classes. The rhizomes are six or eight inches long and rather slender. The skin is peeled off, the flesh grated and washed thoroughly with water. The residue is used to make cassava bread or cakes. The wash water is allowed to stand, when the suspended matter settles. This is used for starching clothes.

A third starch producing plant, quite common along the northern coast of Jamaica, is the coco.[37] This somewhat resembles a giant calla-lily. The rhizomes, or "coco-feet" are roasted and eaten quite commonly by the natives. The arrow-root[38] belonging to the canna family is also grown.

The bread-fruit[39] tree is cultivated, and has become naturalized in many places. The fruit, which looks like a big osage orange, is much relished by Jamaicans, but as was the case with many tropical fruits and vegetables, it seemed to us to lack flavor. Its near relative, the jack-tree[40] with much larger oblong fruit is less common.

The chocho[41] a prickly oblong vegetable resembling a cucumber, is prepared for eating in the same way as squash and tastes like it.

The ocra,[42] not uncommon in northern gardens; bayberry[43] whose leaves are often used for flavoring; allspice;[44] rose-apple,[45] a tree with leaves like the mango, but with large white flowers having numerous long stamens; tamapea/ rind,[46] whose pods contain sweet but slightly acid pulp frequently put up as preserves; pigeon-~~pie,~~[47] calabash,[48] a tree with few wide-spreading, horizontal branches and fascicled, oblanceolate leaves, the fruit of which is made into drinking nuts/ vessels, etc.; the cashew,[49] whose ~~roots~~ taste something like peanuts; the star-apple,[50] a beautiful tree with leaves glossy, dark-green above and ferruginous silky-pubescent beneath; the bimbling[51] bearing its exceedingly sour fruit directly from the trunk; the annatto[52] (spelled also annotto, arnotto, etc.,) with prickly pods, the contents of which yields to water the red coloring matter of commerce; all these are frequent in cultivation, and were to us among the most interesting features of the island

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[35] Dioscorea, alata. etc. (Diosc.)
[36] Janipha Manihot. (Euphorb.)
[37] Colocasia esculenta. (Aroid.)
[38] Maranta sp. (Scitam.)
[39] Artocarpus incisa. (Urticac.)
[40] A. integrifolia.
[41] Lechium edule. (Cucurb.)
[42] Abelmoschus moschatus. (Malvac.)
[43] Pimenta acris. (Myrtac.)
[44] Pimenta vulgaris.
[45] Jambosa vulgaris. (Myrtac.)

Two other plants deserve mention. One is the sorrel[53] ε/ which we observed only in the Luc~~c~~a district, where it is common. It grows to the height of three or four feet, losing its leaves in the fall. The calyx continues to grow and becomes ripe about Christmas. It is then a brilliant scarlet and quite juicy, tasting like Oxalis. The juice is extracted with hot water, flavored with spices and sweetened, thus making a very refreshing drink.

The second plant is the coco or cacao,[54] from which chocolate is made. The peculiarity of this tree is that the small flowers grow in fascicles right out of the trunk. One sees flowers and all stages of fruit on the same tree. The latter when ripe is a dark red in color, ovoid, six or eight inches long, with ten longitudinal furrows. The seeds are washed free from pulp, carefully dried, and (when made by the natives on a small scale) pounded into coarse powder between stones. To this is added cocoanut oil and enough annatto to color it, when it is formed into cylinders about the size of a candle and six or eight inches long. The cocoanut oil is prepared by grating up the ripe nut, usually very laboriously by the use of an ordinary tin grater, boiling the meal with water and skimming the oil off. A little annatto is usually added to give it a yellow color.

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[46] Tamarindus Indica. (Legum.)

[47] Cajanus Indicus. (Legum.)

[48] Crescentia Cujete. Bignon.)

[49] Anacardium occidentale. (Terebinth.)

[50] Chrysophyllum Cainito. (Sapot.)

[51] Averrhoa Bilimbi. (Oxalid.)

[52] Bixa orellana. (Bixin.)

[53] Hibiscus Sabdarifa. (Malvac.)

[54] Theobroma cacao. (Buettner.)

On our way home from Jamaica we stopped for three days at Grand Cayman. This is a small coral island midway between Jamaica and the west end of Cuba, and a dependency of the former. The inhabitants are mostly white, very hospitable, and differ from those of the other islands visited in being active, thrifty and enterprising. Here we saw the walnut,[55] whose fruit resembles our black walnut in taste, shape and in being enclosed in a rather woody shuck.

Another interesting tree which we did not see in Jamaica, was the manchioneal.[56] The inhabitants told great stories about its deadly effects and warned me against it. To test the matter I rubbed some of the fresh juice on the back of my hand, allowing it to remain three hours, without result. This only proves that the plant does not always have the effect ascribed to it. But it seems to be a fact, from the common report, that the juice will frequently form bad sores where it touches the skin. As is the case with our poison ivy, it probably depends upon circumstances and the individual.

During the trip I made collections of seeds, living plants and herbarium specimens which are being studied at the Garden. There are many difficulties in the way of collecting dried plants in the tropics. One of the worst is the humidity of the atmosphere. I succeeded in avoiding all trouble from mould by using drying paper (best quality carpet paper) which had been previously impregnated with corrosive sublimate. I used wire presses, with straps, changed the papers at least twice a day, and frequently exposed the already dried bundles to the sun.

Missouri Botanical Garden, St. Louis.

Notes on the apical growth of Liverworts.

DAVID M. MOTTIER.

(WITH PLATE XIII.)

The striking similarity between the very young thallus of certain liverworts and fern prothallia is a familiar fact to botanists and has led me to suspect that a careful study of the apical growth of several available forms, by more accurate methods than have been heretofore used, might perhaps throw more light upon the affinities of these groups of plants, or add something toward the confirmation of the generally accepted views.

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[55] Aleurites triloba. (Euphorb.)

[56] Hippomane mancinella (Euphorb.)

As is well known, the commonly accepted view of botanists is that growth in the thallus in the Marchantiaceæ and allied forms takes place by means of several initial cells.[1] From careful serial microtome sections of young plants grown from gemmæ of *Marchantia polymorpha* it seems very probable that in these young plants there is only one apical cell. In a series of longitudinal vertical sections of a number of young plants only one apical cell was found (fig. 1). Sections made parallel to the surface (longitudinal transverse) of plants of the same size and age as those just mentioned show two or three cells lying side by side, which have been regarded as initial cells, and may yet be so regarded. Kny (Bau und Entwickelung von Marchantia polymorpha, p. 374) says: "At the bottom of the apical indentation, slightly bent toward the under side, there is a row of cells each of which is bounded externally by a free, slightly curved wall and has two side walls converging slightly toward the front and two posterior meeting the latter at right angles and cutting each other at the back (nach rückwärts). [That is, the apical cell is in the shape of a broad wedge]. Although one or two cells necessarily occupy a middle position within the row, we cannot therefore speak positively of two or more apical cells, because it is not possible to demonstrate that a certain one or two cells form the permanent organic middle point from which regular segments are derived. The possibility is not excluded that by further growth in width on one side of the apical region, one cell, at first exactly in the middle, or its axial descendants, may be pushed to one side." Now from sections parallel to the surface of a young plant of Marchantia polymorpha (fig. 2) it is difficult to say whether cells x, x', and x'', are all apical cells or just one, x. From the statement of Kny just quoted I am rather inclined to think that one cell, x, is the true apical cell, and x' and x'' are segments just cut off in the order indicated. From fig. 3, a similar section of the thallus of *Asterella hemisphærica*, it is seen that very much the same order exists, it being difficult, if not impossible, to decide whether one, x, is the apical cell and x' and

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[1] Schenk: Handbuch, vol. 2, p. 331. 1882. Leitgeb: Untersuchungen ueber die Lebermoose, part 6, p. 2. 1879. Also: part 4, p. 16.

x'' only segments, or whether all are apical cells. Essentially the same thing occurs in *Conocephalus conicus*, *Anthoceros lævis*, and *Riccia*. Moreover as stated in a foregoing paragraph, only one apical cell has been found in longitudinal vertical sections, as shown in figures 1, 4, 5, and 6. Yet it may be, from the fact that this row of cells is arranged in a curved position on account of the hinder part being wider than the fore-edge, that longitudinal sections would pass only directly through the long axis of one cell, the others being cut more or less obliquely, thus obliterating the appearance of the segments of the apical cell. In older plants this might perhaps be more probable, but in young plants (and this was the kind used) the planes of the longitudinal axes do not seem to diverge enough to obscure the arrangement of the segments.

However this may be as to the number of apical cells, such are the facts observed by me, and from these it seems that it is as probable that there is but one as that there are several.

The resemblance between a fern prothallium and a young thallus of Marchantia polymorpha grown from a spore, is indeed very striking, as will be seen upon comparing fig. 7 with a young prothallium. In this (fig. 7) there is but one apical cell whose segments already cut off can be followed without the slightest difficulty. A transverse section through the growing region of a fern prothallium shows a structure similar to that in the liverworts under consideration (fig. 8). Here will be seen one or several initial cells, the number varying with the width of the sinus.

All sections were cut from specimens imbedded in paraffin, by a Minot microtome. The specimens were fixed in chromic acid 1 per cent. or absolute alcohol, stained *in toto* with alum cochineal, and counterstained on the slide with Bismarck brown (70 per cent. alcohol solution). The Bismarck brown is a very satisfactory stain for cell walls.

Indiana University, Bloomington, Ind., March 5, 1891.

Explanation of Plate XIII.—Fig. 1, longitudinal vertical section of growing point of young thallus of Marchantia polymorpha.—Fig. 2, transverse longitudinal section of similar plant.—Fig. 3, transverse longitudinal section through growing point of Asterella hemisphærica.—Fig. 4, longitudinal vertical section of same plant as 3.—Fig. 5, same, of Conocephalus conicus.—Fig. 6, same, of Anthoceros lævis.—Fig. 7, young thallus of Marchantia polymorpha grown from spore (after Kny).—Fig. 8, transverse longitudinal section through the apical region of a prothallium of Onoclea struthiopteris; the shaded cell is the egg-cell of an archegonium.

All figures are magnified about 350 diam. except 6 which is about 175 diam. and 7 about 1200 diam.

Some new Solanaceæ from Guatemala.

JOHN M. COULTER.

Mr. John Donnell Smith submitted to me a bundle of Solanaceous plants from his recent Gautemalan collections. Among them I find the following species which seem worthy of characterization, although in the present confused state of our knowledge concerning this perplexing group absolute certainty seems unattainable. Without any desire of possibly multiplying synonymy these species are put on record as follows:

Solanum Donnell-Smithii n. sp.— Said to be a vine, more or less rough with stellate hairs: prickles stout and subulate or recurved, yellowish, especially stout on the stem, usually more slender on the midrib and principal veins, copious or scanty: leaves rather large and membranaceous, oblong or ovate, sinuate-toothed or lobed, or even entire, 7 to 15 cm. long, with equally 4 to 6-rayed hairs below, and central division much elongated in the otherwise shorter-rayed hairs above: the simple loose few-flowered racemes or cymes soon lateral: calyx deeply 5-cleft, with stout often bulbous-dilated prickles and mostly long-acuminate lobes: corolla 2.5 cm. or more in diameter, whitish or light blue(?), deeply parted into lance-linear lobes, which are thickly stellate-pubescent without: anthers linear-lanceolate: the smooth globose berries becoming 1.5 to 2 cm. or more in diameter, turning red(?).— Escuintla, Depart. Escuintla, alt. 1100 ft., March 1890 (*J. D. S.* 2268); Concepcion, Depart. Escuintla, alt. 1200 ft., April 1890 (*J. D. S.* 2261); San Juan Mixtan, Depart. Escuintla, alt. 500 ft., April 1890 (*J. D. S.* 2262).

Brachistus Escuintlensis n. sp.— Glabrous throughout or minutely puberulent: leaves large and thin, ovate (often broadly so), acute or acuminate, usually oblique at base and more or less tapering into a petiole, entire or with a slightly wavy margin, very unequal in size, the largest becoming 20 to 23 cm. long and 12 to 13 cm. broad: flowers on pedicels of various lengths in umbellate axillary clusters along the main stem or on leafy branches: the short and broadly campanulate calyx with an entire margin (rarely a few almost indistinguishable teeth): corolla about 12 mm. long with 5 erect lobes 4 or 5 mm. long: berry globose, 8 to 9 mm. in diameter.— Escuintla, Depart. Escuintla, alt. 1100 ft., March 1890 (*J. D. S.* 2267).

Bassovia Donnell-Smithii n. sp.—Said to be 24 dm. high, more or less softly pubescent or even hirsute, the upper parts of the stem and inflorescence glandular: leaves ample and thin, petioled, ovate to ovate-lanceolate, acuminate, from almost entire to sharply sinuate-toothed or lobed, 7.5 to 17.5 cm. long, minutely pubescent above, more conspicuously pubescent below, the midrib and principal veins usually prominently bordered by dense whitish pubescence: flowers on long pedicels in rather dense axillary umbellate clusters: the glandular calyx with small but evident teeth: corolla with ovate obtuse or acute glandular lobes 5 or 6 mm. long: anthers whitish-scarious along the lines of dehiscence: "fruit red".—Gautemala, Depart. Guatemala, alt. 5000 ft., February 1890 (*J. D. S.* 2270); Dueñas, Depart. Zacatepequez, alt. 5000 ft., April 1890 (*J. D. S.* 2258).

BASSOVIA MACROPHYLLA. — Pansamalá, Depart. Alta Verapaz, alt. 3800 ft., April 1889 (*Türckheim* 1438). This plant was at first considered to be a variety of the new *B. Mexicana* B. L. Robinson, of Pringle's distribution of 1890, and is so reported in Mr. Smith's "Enumeration", Part II. However, Mr. Robinson has since kindly looked into the matter, and the conclusion seems evident that it is the South American Witheringia macrophylla, a plant of puzzling synonymy. Bentham and Hooker refer it to *Bassovia*, and Miers to *Brachistus*. The disposition made of it by Bentham and Hooker seems to be the most natural one.

Crawfordsville, Ind.

BV 0020880

New Grasses.

GEORGE VASEY.

The discovery of a second species of Orcuttia makes it necessary to somewhat modify the generic characters. They should now read as follows:

[Tribe FESTUCEÆ, sub-tribe *Sesleriecæ.*] **Orcuttia.**— Panicle somewhat spicate, with short, simple, alternate, sessile spikelets, somewhat distant below, and crowded toward the summit: spikelets many flowered, compressed: empty and flowering glumes much alike, with many prominent straight nerves, strongly toothed or lobed at the apex: palet equaling its glume, narrow, thin, green on the strongly angled keels: anthers 3, styles 2, filaments and styles projecting beyond the apex.

Orcuttia Greenei n. sp.—Apparently annual, culms cespitose, many from one root, erect, finely pubescent, 8 to 10 inches high, with 8 or 10 nodes: sheaths shorter than internodes, loose, the lower ones particularly so, pubescent and striate: leaves erect, rigid, narrow, 1 to 1½ inches long, pungently pointed, the upper sheathing the base of the panicle: panicle 2 to 3 inches long, somewhat flattened, of 10 to 15 contiguous spikelets: spikelets flattish, ¼ to ½ inch long, of 5 to 15 flowers; empty glumes two-thirds as long as the flowering ones, all sparsely pubescent, green, oblong, with strongly toothed apex; flowering glumes 2 to 2¼ lines long, with about 5 sharp teeth at apex, folded excentrically; palet as long as its glume, narrow, strongly 2-keeled and hispid on the keels.—Collected on moist plains of the upper Sacramento, near Chico, California, June, 1890, by *Prof. E. L. Greene.*

Eragrostis spicata n. sp.—Culms perennial from strong rhizomes, erect, rigid, 3 to 4 feet high: leaves distant, rigid, erect, 10 to 15 inches long, involute toward the apex, sheaths longer than the internodes, ligule inconspicuous: panicle spike-like, very narrow, cylindrical, densely flowered, 10 to 15 inches long, tapering at top, branches closely appressed: spikelets about 3-flowered, 1 line long; empty glumes half as long, the upper broader, both obtuse or truncate, short ciliate on the keel; flowering glumes 3-nerved, short-falcate.—Collected at San Jose del Cabo, Lower California, by *T. S. Brandegee,* 1890.

Muhlenbergia Alamosæ n. sp.—Perennial, tufted: culms numerous, compressed or angled, erect, 2 to 2½ feet high, wiry, rarely with 1 or 2 branches near the base, with about 6 nodes, the upper ones distant: lower cauline leaves erect, short, 2 to 3 inches long, the uppermost 8 to 10 inches long, equalling the panicle: panicle 4 to 5 inches long, 1 to 2 inches wide, open, the branches in threes or fives below, unequal, capillary, the lower third or half naked, the upper part 15 to 20-flowered, pedicels short, diverging: spikelets purple, over 1 line long; empty glumes ovate-acuminate or awl-pointed, half as long as the flowering glume, which is white barbed below on the margins and on the nerves of the palet; awns flexuose, 6 to 8 lines long.— Collected at Alamosa in Sonora by *Dr. Ed. Palmer*, 1890, no. 407.

Calamagrostis densus n. sp.— Culms in large patches, from strong rootstocks, 3 to 4 ft. high, robust, leafy, 5 to 6 nodes; the lower sheaths loose and longer than the internodes, the middle ones shorter than the internodes, the upper including the base of the panicle; leaves often a foot long, rigid, plane or becoming somewhat involute at the long slender points, somewhat scabrous, as are the sheaths; ligule 1 line long, lacerate: panicle strict, lance-oblong, 4 to 6 inches long, rachis slightly scabrous, branches somewhat verticilate, appressed, 1 inch long and densely flowered: spikelets crowded, 2 to 2½ lines long; outer glumes linear-lanceolate, nearly equal, acute, slightly scabrous, margins slightly scarious; third (or flowering) glume a little shorter, narrow, apex slightly toothed and mucronate, a few short hairs at the base; awn, twisted near the base, a little longer than its glume; palet a little shorter than the glume, thin; sterile tuft, slender, one-third to one-half as long as the glumes, with few hairs.— Collected near Julian, San Diego co., California, by *C. R. Orcutt.*

Calamagrostis kœlerioides n. sp.—Culms erect, 2 feet high, rather rigid, smooth: leaves 2 to 6 inches long, narrow, somewhat scabrous, ligule conspicuous, laciniate, blade rigid, pointed, the upper very short: panicle spike-like, narrow, 3 to 4 inches long, the branches in short, approximate (or at the base rather distant) clusters: spikelets about 2 lines long, linear-lanceolate, rather smaller, but otherwise much as in *Calamagrostis densus;* the panicle having much the appearance of *Kœleria cristata.*—Collected near Julian, San Diego co., California, by *C. R. Orcutt.*

Department of Agriculture, Washington, D. C.

BRIEFER ARTICLES.

Simple mechanism to show geotropism.—Take the works of an old clock run by a weight rather than a spring and support them horizontally, i. e. with the shafts vertical. The weight is to be carried over a pulley outside the works and the pendulum is to be removed so that the wheels may be made to revolve at a much more rapid rate than in the clock. One of the shafts, that bearing the scape wheel, is longer than the rest, so that the scape wheel is outside the frame, i. e. above it in the position described, being supported by a bearing not in the frame itself, but in a separate piece bent and riveted to the frame. This piece must be cut away and a new bearing made for the shaft under the scape wheel instead of above, which any ingenious boy can easily do. This leaves the scape wheel free to carry the seed pans.

Solder the middle of a stout, horizontal brass wire six inches long to the face of the scape wheel, and to each end of this wire a deep tin pill-box, an inch and a half in diameter, one for a seed pan and the other to be filled with ballast for a counterpoise. The edge of the pill-box, not its face, should be towards the wheel, and the face of it should be inclined at an angle of about sixty degrees to the horizon so that the radicles of the germinating seeds in their downward growth may press against the advancing face of the box. Most of this face should be cut away and a piece of glass put inside to serve as a window. Against this put the seeds, already germinated so that their radicles begin to appear, placing the radicles so as to point downward; fill the box with moist saw-dust, and set it going in a warm place, using a heavy driving weight (I used about twelve pounds). This will make the brass arms carrying the pill-boxes revolve at a sufficient rate to create considerable centrifugal force in the boxes. The germinating radicles will feel the force of this enough to deflect them at a considerable angle from the perpendicular.

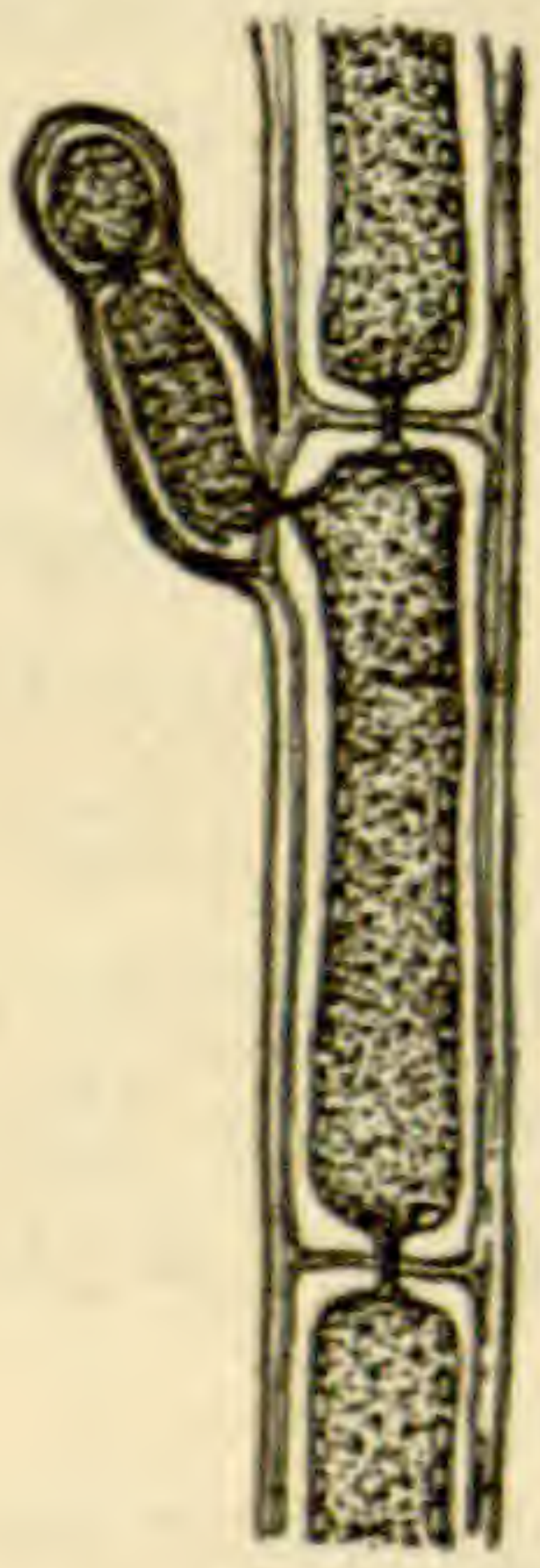
The apparatus will run several hours and if you do not want to sit up nights to wind it, all the better, as the direction of growth during the night will be so obviously different from that during the day when the apparatus is running as to make the experiment more conclusive. —GOODWIN D. SWEZEY, *Crete, Nebraska.*

Notes from Columbus, Ohio.—Among my last summer's collections from this vicinity was a form of *Bidens connata* Muhl. which was typical in every respect except that it had upwardly barbed awns. Dr. Sereno Watson, to whom the specimen was submitted, pronounced it unchanged in other characters. In making a revision of Sullivant's catalogue of plants of this vicinity, I find mention of plants near *B. frondosa* L., "except smaller and smoother; heads fewer-flowered, with pappus upwardly scabrous."

The following species of western plants, with the exception of Dysodia (not heretofore known in this locality), were collected the last of October about the winter-quarters of Sells Brothers' Circus, at Sellsville, Ohio, near Columbus, the Croton alone being out of bloom: Erodium cicutarium, Aster pauciflorus, Amphiachyris dracunculoides, Dysodia chrysanthemoides, Gutierrezia Texana, Helenium nudiflorum, H. tenuifolium, Parthenium Hysterophorus, Solanum rostratum, Monarda citriodora, and Croton capitatum. The plants were first noticed by W. J. Greene of the Ohio Experiment Station, and appeared to be growing well and spreading. The seed was evidently scattered from cars or wagons upon the return of the show at the close of the season.—AUG. D. SELBY, *Columbus, Ohio.*

Continuity of the protoplasm in the Chantransia form of Batrachospermum.—Strasburger (Botanisches Practicum, p. 403, 2nd German edition), mentions the fact of the continuity of the protoplasm between the cells of filaments of Batrachospermum. The writer's attention was attracted to this phenomenon while studying the Chantransia form of one of the species of Batrachospermum, probably Chantransia (Batrachospermum) macrospora, from Florida; and the protoplasmic connection was so evident that he thought the readers of the BOTANICAL GAZETTE might be interested in his observations.

The phenomenon was first noticed in a slide of the alga which had been mounted in glycerine jelly. In preparing the specimen for the jelly the glycerine had caused a slight shrinkage of the cell-contents, drawing it away from the cell-walls in all parts of the cells except at the ends, where fine threads of protoplasm which pierced the end walls were plainly seen to connect the shrunken masses of protoplasm in the different cells. The figure, showing this condition, was drawn from a filament on this slide with a Abbé camera, power 600 diameters, (reduced one-half).



A very sasisfactory way of demonstrating the presence of the connecting fibril is to stain the alga filaments with an alcoholic solution of eosin, wash in water, and then carefully shrink the contents of the cells with dilute glycerine. The water washes the eosin out of the cell-walls leaving the granular matter of the cells deeply stained and the connecting protoplasmic threads slightly colored. Borax carmine also gave satisfactory results. Iodine and methyl violet did not differentiate clearly enough, the cell-walls being so deeply stained as to obscure the protoplasmic connections. However, the green filaments, with the contents shrunken a little, exhibit the connecting fibril in an unmistakable way. The Chantransia form is better to demonstrate the continuity of the protoplasm than the sexual form, because the cells are as a whole much larger.—BRADLEY M. DAVIS, *Indiana University, Bloomington.*

A method of studying the growth of tubers.—After a careful examination of all the literature on tubers and tubercles at hand it appears that the application of the Baranetzky auxanometer to a study of their growth is either unknown or rarely practiced. No record of such use can be found. The writer therefore ventures to note a method of setting up the apparatus, for this purpose, which is now being employed with good results in the botanical laboratories of the University of Minnesota.

Potatoes are selected that make the tubers habitually some distance from the base of the aerial stem. The soil is removed through a separable side of the culture-box and a tuber is exposed. This is blocked up rigidly from below, in such a manner that no downward movement of the tuber can take place. A jacket made of two small square pieces of cigar-box wood is now fitted on the upper and under sides of the tuber, the lower piece resting on the block below. The pieces are held around the tuber by means of very slender rubber-bands and by small cleats on their faces which grip the tuber gently. The upper of these squares of wood is furnished with a central screw to which the thread of the tracing wheel is attached. The whole is then covered with soil and the side of the box replaced. The smoked cylinder is now brought into position, the battery and clock connected and the tracing-needle adjusted. The clock should be set to release the armature every three hours. Now, when growth takes place in the tuber, since no movement downward can ensue, the thread is released and the tracing-needle makes a vertical stroke, indicating the growth. (See Vines : Physiology p. 399; Sachs : Physiol. Eng. trans. p. 557; Pfeffer : Pflanzenphysiologie II, p. 86; Detmer : Handbuch Pflanzenphys. p. 257; Goodale : Physiol. Bot. p. 383.)

Experiments made up to date indicate but do not demonstrate a daily periodicity in the growth of the potato tuber. If such is the case two explanations would at once suggest themselves. Since the apparent maximum of growth in this organ lies between 10 P. M. and 8 A. M. it might be compared with aerial shoots and the rhythm be considered a hereditary trait, as the embryonic positive-heliotropic curvature of ivy shoots. More reasonable, however, would be the other explanation, co-ordinating the daily rhythm of the tuber with the rhythmic production of starch in the assimilating surfaces.

A more extended series of experiments along this line is being conducted by Mr. C. P. Lommen and he will doubtless be able to speak more fully upon the matter later on. This note merely calls attention to the method of study.—CONWAY MACMILLAN, *University of Minnesota.*

A monstrous form of a common field daisy.—The plant which I am about to describe was received from Virginia where it was found blooming in a fence corner in December last during a period of warm sunny days and occasional sharp, frosty nights.

The head is normal as to the involucre, the white rays and a zone of a certain width of disk flowers. Then however comes a zone of ray flowers again, standing more or less upright and looking outwards; and surmounting the rounded summit of the receptacle is a tuft of the brown bordered scales quite similar except as to size to those of the involucre. There is no extension of the normal axis and no tendency to a repetition of the flowering or vegetating shoot; hence it is not an example of the not uncommon *proliferation* unless we should call it a case of inverted proliferation which would not be accounting for its existence.

The explanation which I would offer is based upon a hint obtained from Sachs's Plant Physiology where he describes an abnormal sunflower in illustrating the principles of acropetal succession in growth. I should say that an injury, possibly cold, arrested growth at the developing apex of the receptacle when this latter was still quite young so that it ceased to be the growing point. Just below and round about this region renewed proliferation of embryonic tissue began and proceeded backwards towards the older parts, forming a new growing zone to which the arrested original growing point now stood in the same relation as the older parts in the ordinary receptacle stand to the normal growing apex or centrum. In further development the disposition of the members of the inflorescence would now be in the true but inverted progressive sequence from the older to the newer parts of the axis; that is, the abnormally placed involucral scales about the center, followed by the ring of ray flowers and these succeeded by the disk flowers which merge into those of the unaltered parts of the receptacle.—B. W. BARTON, *Baltimore, Md.*

EDITORIAL.

IT REALLY SEEMS that the flood gates have been opened in the matter of priority in nomenclature and that we are to be deluged with ancient names for well-known plants. That too great conservatism may have withheld the authors of our floras from making needful changes may be conceded to those who are radical reformers, since it is of no importance for our present purpose. But the search after new-old names is leading those who are making changes into some ludicrous and even ridiculous blunders. It is not our intention to single out examples of these from the numerous ones in recent publications. Rather it is our endeavor to stay the tide of folly.

MANY BOTANISTS who appreciate their limitations in the matter of describing new species, ignore or underrate their limitations in the matter of nomenclature. It is vastly easier as a rule to determine and describe a new species than to settle on the oldest proper name of a plant. In the latter, experience is of even greater value than in the former. Those who think it a mere matter of searching through books will find in their undoing that it is much more.

IS IT not also curious, from a psychological point of view, that one who is compiling a local flora or writing an article on local plants, should decline to use the names applied to the plants in the flora of the country — names which it is quite certain designate unmistakably what plant is meant — and should go searching after other names which *may* be older and *may* be applicable to the plants under consideration? Is it not evident that something other than a clear indication of the plants is sought? Is it the cheap renown of differing from "an authority?"

WHILE LESQUEREUX and James's Manual is the best book on the mosses of North America, let us use the names therein, even though we see their faults. While Gray's Manual remains the best book on the flowering plants of its range let us use its names, and "therewith be content." And so of every book. Accept the best till there is a better. Only when monographing a group has one a moral right to discard any name however bad.

CURRENT LITERATURE.

Minor Notices.

PLANTÆ EUROPEÆ is the title of an important work by Dr. K. Richter, whose first volume has just appeared. It is intended to be a systematic enumeration, with synonymy, of the indigenous phanerogams of Europe. The first volume contains 378 pages, with a very complete index, and presents the Gymnosperms and Monocotyledons. In the matter of nomenclature the oldest specific name is adopted, in whatever genus it has appeared. The Gymnosperms show 8 genera and 40 species; while the Monocotyledons have an enumeration of 251 genera and 1799 species. The largest family is Gramineæ, with 751 species, followed by Liliaceæ (342 species), Cyperaceæ (287 species), Orchidaceæ (170 species), and Iridaceæ (105 species). The work is an exceedingly important one, not only in bringing together in handy form all the species of phanerogams with their synonymy, but also in helping establish the nomenclature of European plants. It is published by Wilhelm Engelmann of Leipzig.

A HANDBOOK of Geographical Botany, by Dr. Oscar Drude, has recently been issued from the press of J. Engelhorn of Stuttgart, as one of a series of geographical handbooks under the general direction of Dr. F. Ratzel. The book contains nearly 600 pages and several colored maps, and is altogether one of the most complete compends of phytogeography that has appeared. The relation of plants to environment is discussed in all its ramifications. The conditions which cause a special display of certain plant groups in different regions are fully considered; and finally the different plant regions of the earth (some twenty-one principal ones) are described. We would commend this book to any would-be translator, as one that deserves to be speedily translated into English, for its range is world-wide and its usefulness should be equally extensive.

AN INTERESTING WORK, by A. Osw. Kihlman, entitled "Pflanzenbiologische Studien aus Russisch Lappland," has just been published in Helsingfors (Finland). It appears as a part of the Proceedings of the Finnish Biological Society. The book contains 300 pages, many additional tables, 14 plates, and a colored map. The plates, which are reproduced from photographs, are exceedingly interesting, showing the landscape of Lapland and the characteristic plant life. The flat land, the scraggy shrubs and trees, the deep snows, and the altogether dreary look make a strong impression. Of course, all this is but superficial; and the effect of these conditions on plant life is the theme which is fully discussed.

OPEN LETTERS.

To phytographers, especially Cryptogamists.

La longue expérience que j'ai faite dans l'élaboration de mon *Sylloge Fungorum omnium* m' a persuadé de l'utilité, je dirai même de la nécessité, de suivre dans la description des plantes certaines règles qui sont trop souvent négligées. Voici ces recommendations:

1. Il est nécessaire que les botanistes qui décrivent des espèces nouvelles en les traitant du point de vue de la morphologie et de la biologie, avec des détails très minutieux et très compliqués, y joignent des diagnoses spécifiques ou génériques (préférablement en latin) concises et comparatives selon les règles phytographiques. En effet il est très difficile et souvent très ambigu de choisir dans la foule des détails les caractères essentiels et différentiels.

2. La phrase spécifique ou diagnose est, pour certains auteurs particulièrement cryptogamistes, excessivement détaillée et prolixe et trop laconique pour d'autres. Une bonne phrase spécifique doit donner, en forme assez concise et claire, seulement les caractères essentiels et différentiels. Toute observation de détail doit être relèquée après la diagnose. Il est encore nécessaire pour les espèces nouvelles d'indiquer son affinité avec les autres connues plus prochaines. Celui qui détermine des espèces nouvelles sait combien de temps il doit perdre pour la détermination s' il a à faire avec des diagnoses très prolixes et sans notions d' affinité.

3. L'expèrience a déjà démontré, du moins dans la cryptogamie, qu'il est très utile, pour la désignation de la patérnité d'une espèce, d'indiquer entre parenthèses l'auteur qui a le premier décrit sous d'autres genres cette espèce. Il est toujours nécessaire d'ajouter le nom de l'auteur qui a transporté l'espèce du genre primitif à un autre, car sans cela on devrait entendre que l'auteur de l'ouvrage où la combinaison des noms est citée, est également l'auteur de cette combinaison. Nous trouvons par ex. dans les écrits de Winter des noms semblables: "*Sphærella convexula* (Schwein.) Syn. *Sphæria convexula* Schwein." Si nous n'ajoutons pas le nom Thümen après la parenthèse nous devrions croire que Winter est l'auteur de la combinaison; et alors nous aurons d'après les règles d'autres botanistes les deux notations suivantes: *Sphærella convexula* (Schwein.) Wint. ou *Sphærella convexula* Wint. qui sont toutes les deux fausses. Mais si nous disons *Sphærella convexula* (Schwein.) Thüm. nous avons la notion très exacte que Schweinitz a créé l'espèce et que Thümen l'a rapportée à son juste genre.

4. En décrivant les cryptogames parasites, il faut citer les plantes ou les animaux nourriciers avec la nomenclature technique latine. Les noms vulgaires (anglais, italiens, etc.) sont souvent difficiles à être identifiés.

5. Pour les mesures des organes tant microscopiques que macroscopiques, il est nécessaire d'adopter une mesure unique, savoir celle métrique; pour les mesures microscopiques, laissant de côté toute fraction, on devra préférer les micromillimètres ou microns (*micra*, μ). Les différentes mesures et les fractionnaires sont très souvent cause d' erreur ou de doute.

6. Pour désigner briévement les dimensions des organes microscopiques il convient (comme du reste plusieurs le font) d'indiquer d' abord le chiffre de la longueur et ensuite celui de la largeur plus grande avec le signe $\overset{\smile}{\smile}$ entre l'une et l'autre en se passant du signe μ; si l' organe est comprimé on pourra ajouter encore le chiffre de l'épaisseur, par ex. : spore $15 \overset{\smile}{\smile} 4$ signifie spore longue 15 μ et large et épaisse 4 μ; spore $15 \overset{\smile}{\smile} 4 \overset{\smile}{\smile} 2$ signifie spore longue 15 μ, large 4 μ et épaisse 2 μ. Plusieurs auteurs au lieu du signe $\overset{\smile}{\smile}$ (que j 'ai proposé et suivi depuis 1872) emploient les signes =, : ,×, qui pour les mathématiciens ont une signification différente et définie. Pour les organes macroscopiques on devra indiquer la qualité de la mesure, savoir m., cm., mm. et la partie mesurée.

7. Dans la désignation de tous les groupes des plantes en général on emploie des noms féminins (*Dicotyledones*, *Ranunculaceæ*, *Anemoneæ*, etc.; on devra faire de même pour les Cryptogames; ainsi si nous

disons *Sphæriaceæ*, *Mucedineæ*, *Hydneæ*, etc., nous devrons necessairement dire aussi: *Pyrenomyceteæ*, *Hyphomyceteæ*, *Hymenomyceteæ* et non *Pyrenomycetes*, *Hyphomycetes*, *Hymenomycetes* comme voudraient beaucoup d' auteurs.

8. Les couleurs des plantes et particulièrement celles des corolles, des Champignons, des spores etc., sont souvent décrites avec des noms de signification incertaine. Il serait bien d' employer une nomenclature défine appuyée à des échantillons normales. Je vais publier à cet effet une *chromotaxie* qui sera, je l' espére, de grande utilité.

9. Pour ce qui concerne la nomenclature des fruits et des spores des Champignons, il serait utile d'employer seulement la suivante, qui au reste est adoptèe par la plupart des mycologues:

Hymenomyceteæ: Pileus (quelle forme qu'il soit) ; basidia; sterigmata; sporæ; cystidia.
Gasteromyceteæ et *Myxomyceteae*: Peridium; gleba; capillitium; flocci; sporæ.
Uredineae: Sorus; uredosporae; teleutosporæ; mesosporae; pseudoperidium; æcidiosporæ; paraphyses.
Ustilagineae: Sorus; sporæ.
Phycomyceteae: Oogonia; oosporæ; antheridia; spermatia; zygosporæ; azygosporæ; zoosporangia; zoosporæ.
Pyrenomyceteae et *Phymatosphaeriaceae:* Stroma; perithecium; loculi; ascus; sporidia; paraphyses.
Discomyceteae et *Tuberoideae*: Ascoma; gleba; ascus; sporidia; paraphyses.
Schizomyceteae: Filamenta; baculi; cocci; endosporæ; arthrosporæ.
Sphaeropsidae: Perithecium; basidia; sporulæ.
Melanconieae: Acervulus; basidia; conidia (et non *gonidia*, nom qui doit être reservé aux Lichens).
Hyphomyceteae: Caespitulus; sporodochium; hyphae; sporae.

OBS.: Si la spore germe, il se forme le promycelium qui généralement produit les sporidiola.— P. A. SACCARDO, *Padua, Italy.*

NOTES AND NEWS.

PROF. MAXIMOWICZ, of St. Petersburg, well known to all students of systematic botany, died February 16.

M. MARCEL BRANDZA is publishing in *Revue générale de Botanique*, an exhaustive paper on the development of the seed coats.

IN *Le Botaniste* (Feb. 25) M. P. A. Dangeard has a valuable illustrated paper on the morphology and anatomy of *Tmesipteris.*

THE REPORT of the mycologist, Dr. Roland Thaxter, to the Connecticut experiment station for the year 1890, is devoted to an extended account of the deep scab of potatoes and the organism that produces it, notes on several other plant diseases, and an excellent account fo certain fungicides and methods for their application.

UNDER THE EDITORSHIP of Prof. L. H. Bailey, the *American Garden* has become the sprightliest and most readable of the journals of its class.

THE FIRST BULLETIN of the Agricultural Experiment Station of North Dakota deals with grain smuts, a contribution by the Botanist, Mr. H. L. Bolley.

IN THE first of the Beihefte zum Botanisches Centralblatt F. Ludwig gives a résumé of the papers appearing during 1890 on the relation between plants and snails.

PROFESSOR JOHN M. COULTER has been elected President of the State University of Indiana, and will enter upon his duties at Bloomington next September.

IN *Journal of Botany* (March), Mr. T. D. A. Cockerell gives some account of the conspicuous European weeds that have become naturalized in the United States.

A POPULAR volume by M. C. Cooke, on the subject of edible fungi, will be issued shortly. It will be of a moderate size and price, and will contain colored plates of forty-four edible species.

M. A. LOTHELIER has shown by experiments that plants like Berberis or Hawthorn produce spines more freely in direct proportion to the degree in which they are exposed to the light.— *Gard. Chron.*

DR. EDWARD PALMER has recently returned from a three months collecting trip at Manzanilla and Colima, Mexico, having obtained about 500 species. These species will be reported upon by the botanists of the Department of Agriculture.

IN AN account in the *Botaniska Notiser* of European Uredineæ occurring at Quito, J. G. Lagerheim describes a new parasite of Puccinia graminis, which he calls *Fusarium Uredinis.* It attacks the uredosori, giving them a pinkish color.

IN *American Garden* (March), Mr. Walter Deane gives an interesting and illustrated account of the native orchids of New England. Every species seems to be mentioned and in a very readable way by one who knows them well in their native haunts.

FOUR SPECIES of North American plants have become established in the vicinity of Pavia, Italy, according to M. Bozzi (Atti. Soc. Ital. Sc. Nat., xxxi, p. 281). They are Oxybaphus nyctagineus, Commelina Virginica, Elodea Canadensis and Azolla Caroliniana.

THE SUMMER COURSE in botany at Harvard University will begin at the Botanic Gardens June 29, and continue five weeks. It will be under the instruction of Mr. W. F. Ganong, Instructor in Botany, and Mr. G. F. Pierce, Assistant in Botany, in Harvard University.

DR. DOUGLAS H. CAMPBELL has been appointed Associate Professor of Botany at the new Stanford University of California. As the Pacific slope is already well supplied with workers in systematic botany, that subject will not be represented at present in the new University.

A SORGHUM smut (*Ustilago Reiliana* Kühn) new to the United States is recorded by Messrs. Kellerman and Swingle (Trans. Kans. Acad. Sci., xii, 158), as occuring in Kansas. It attacks the panicle, and reduces it to a more or less uniform mass of spores. In Europe it also attacks the staminal inflorescence of Indian corn.

DR. W. J. BEAL has issued a bulletin (no. 72) describing the six worst weeds of Michigan. They prove to be Cnicus arvensis, Lithospermum arvense, Verbascum Blattaria, Linaria vulgaris, Plantago lanceolata, and Rumex crispus. A sample of the seeds of each is glued upon one of the pages, so that the farmer may intelligently examine his seed before sowing.

IN HIS "Notes on North American Trees," Professor C. S. Sargent has taken up the genus Acer (*Garden and Forest*, April 1). In regard to the confused synonymy of our sugar maple, the author inclines to the use of Michaux's name *A. barbatum*. Following most late authors, he merges Negundo into Acer and uses the Linnæan *Acer Negundo* as the name of our box elder.

WE NOTE with pleasure that Mr. Thomas Meehan, the editor of the *Gardeners' Monthly* until its discontinuance at the death of the publisher, and so long and widely known by his botanical writings, will soon begin the publication, assisted by his sons, of a new journal of gardening and botanical miscellany. It will be known as *Meehan's Monthly*, and the first number will appear July 1.

THE BOTANICAL CLUB of Washington has begun to make arrangements for entertaining the botanists of the A. A. A. S. They are intending among other things to issue a souvenir of about 40 pages, giving some account of the trees and shrubs of the streets and parks, with photographic illustrations. The large number of botanists in Washington will no doubt do all in their power to make a week's stay pleasant for visiting botanists.

MR. GEO. B. SUDWORTH shows in *Garden and Forest* (April 8) that if botanists adhere to the priority of specific name as rigidly as zoologists, that three of our well known plants should be called Negundo Negundo, Sassafras Sassafras, and Catalpa Catalpa. It occurs to us that his point is well taken. These extraordinary combinations seem not to have given zoologists any trouble, as a list of names from Jordan's "Manual of Vertebrates" testifies.

NEARLY ONE-TENTH of the British *Agaricini*, the group of mushrooms and toadstools, are good eating, as we learn from *Grevillea* (xix, 83). There are 1,400 species in the British Isles, of which somewhat over half are too small, rare or tough to be of culinary value. This leaves 680 species that may be edible. Of this number 134 are known to be suitable for the table, some 30 are poisonous, and of the remaining 516, nothing certain is known.

THE POPULAR notion that the sunflowers turn with the sun has been put to the test by W. A. Kellerman, who records (Trans. Kans. Acad. Sci., xii, 140), a large number of observations on the wild Helianthus annuus. He finds that about 87 per cent. of the heads while in bloom show movement during the day, and a less percentage at night, but they usually turn through only a few degrees of arc. During the day 23 per cent. move somewhat toward the west, and 8 per cent. in the opposite direction. At night 21 per cent. move eastward, and 8 per cent. westward.

ANOTHER considerable contribution has been given by Mr. F. Boergesen in his "Desmidieæ" [1] to the knowledge of this group of Algae from Brazil. The material had been collected by Glaziou in St. Paul, and the number of about 130 species and varieties includes about 50 new ones, illustrated in four plates, finely prepared by the author himself. Of species and varieties enumerated, the largest numbers belong to the genera Cosmarium (29), Staurastrum (24), Closterium and Euastrum (16), Micrasterias (10), etc. The diagnoses are all given in Latin.—T. H.

WE are glad to welcome the first annual Bulletin of the Swiss Botanical Society. It is a volume of nearly 170 pages, with 3 plates, and contains original papers by Dr. H. Christ, Prof. Dr. Cramer, Dr. J. Früh, and Dr. H. Schinz. In addition to this there is an account of communications made to the society, among which we note a revision of *Krameriaceæ* in which *K. lanceolata* Torr. is made var. *angustifolia* of *K. secundiflora* DC. A good feature is an excellent and full résumé of the botanical work done during 1890 which had any reference to the Swiss flora.

THE PRODUCTION of tubercles on the roots of English beans has been accomplished by M. W. Beyerinck (Bot. Zeit., xlviii, 837) by growing the beans in a sterilized soil and applying pure liquid cultures of bacteria. The apparatus employed is of new and ingenious design. The experiments so far completed show that the tubercles on the various leguminous plants are not due to a single species of bacteria, but to several, which are also distinct from the soil bacteria producing nitrification. They also establish the fact that the bacterial growths do not originate within the plants, for the roots remained free of tubercles so long as the cultures of the specific bacteria were not introduced.

AN EARLY collapse of the plan of publishing general Fungi Exsiccati is predicted by M. C. Cooke in the last number of *Grevillea,* on the ground that there are too many being issued with too much duplication, both in the same and in different series. He notes that Puccinia graminis appears under six numbers in one series, and also under six numbers in another series, and both sets by the same collector. Pleospora herbarum appears under eleven numbers in one series, and under eighteen in another. A long list of American species is given, each species of which has been issued in from one to three American series and in as many foreign ones also. He advocates the publication of series restricted to certain groups. These views must meet the approval of the majority of mycologists.

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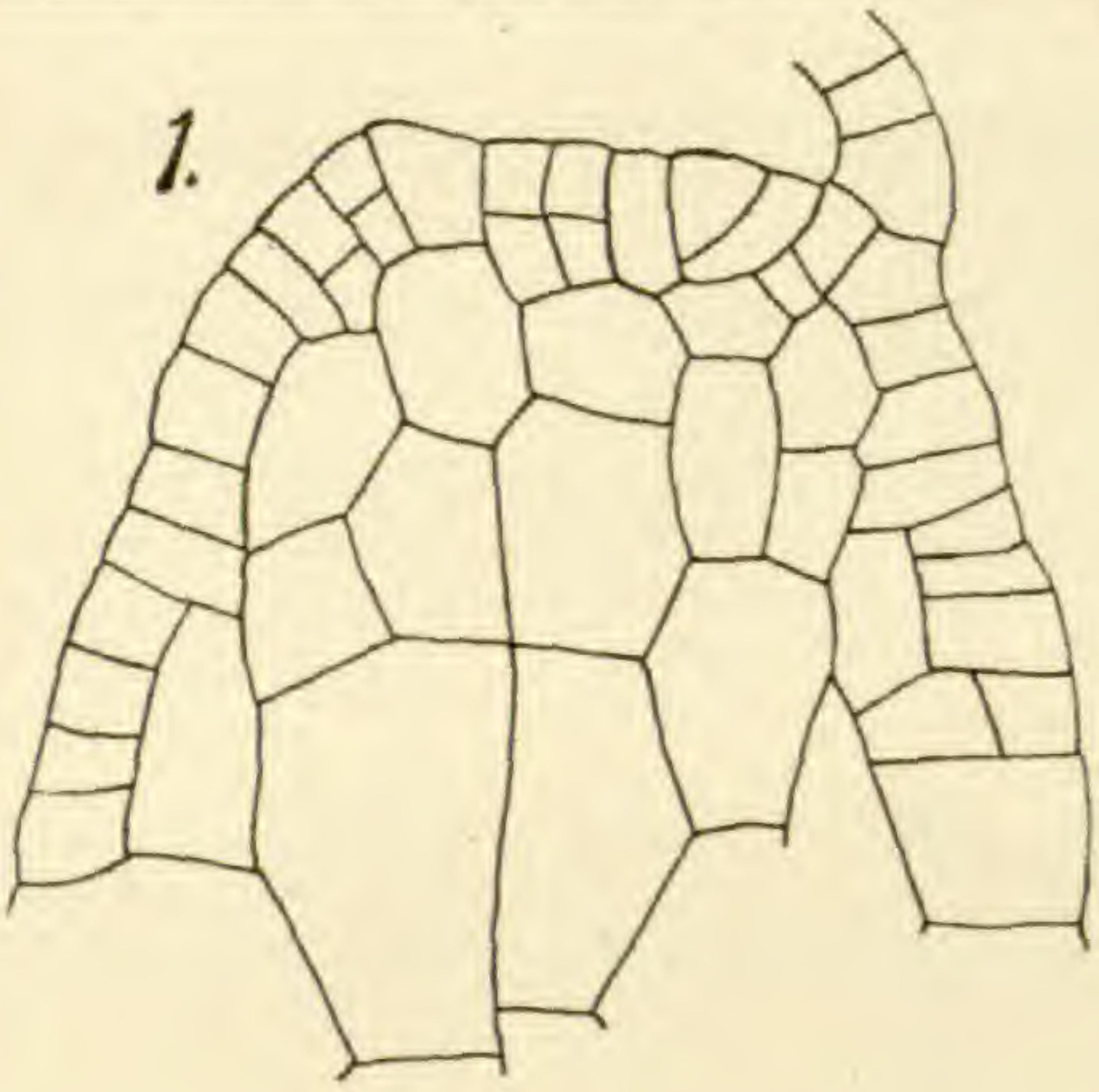
[1] Eug. Warming, Symbolae ad floram Brasiliae Centr. cognosc. Particula XXXIV. Saertryk af Vidensk. Meddel. fra Naturhist. Forening, 1890. Copenhagen.

BOTANICAL GAZETTE, 1891. PLATE XIII.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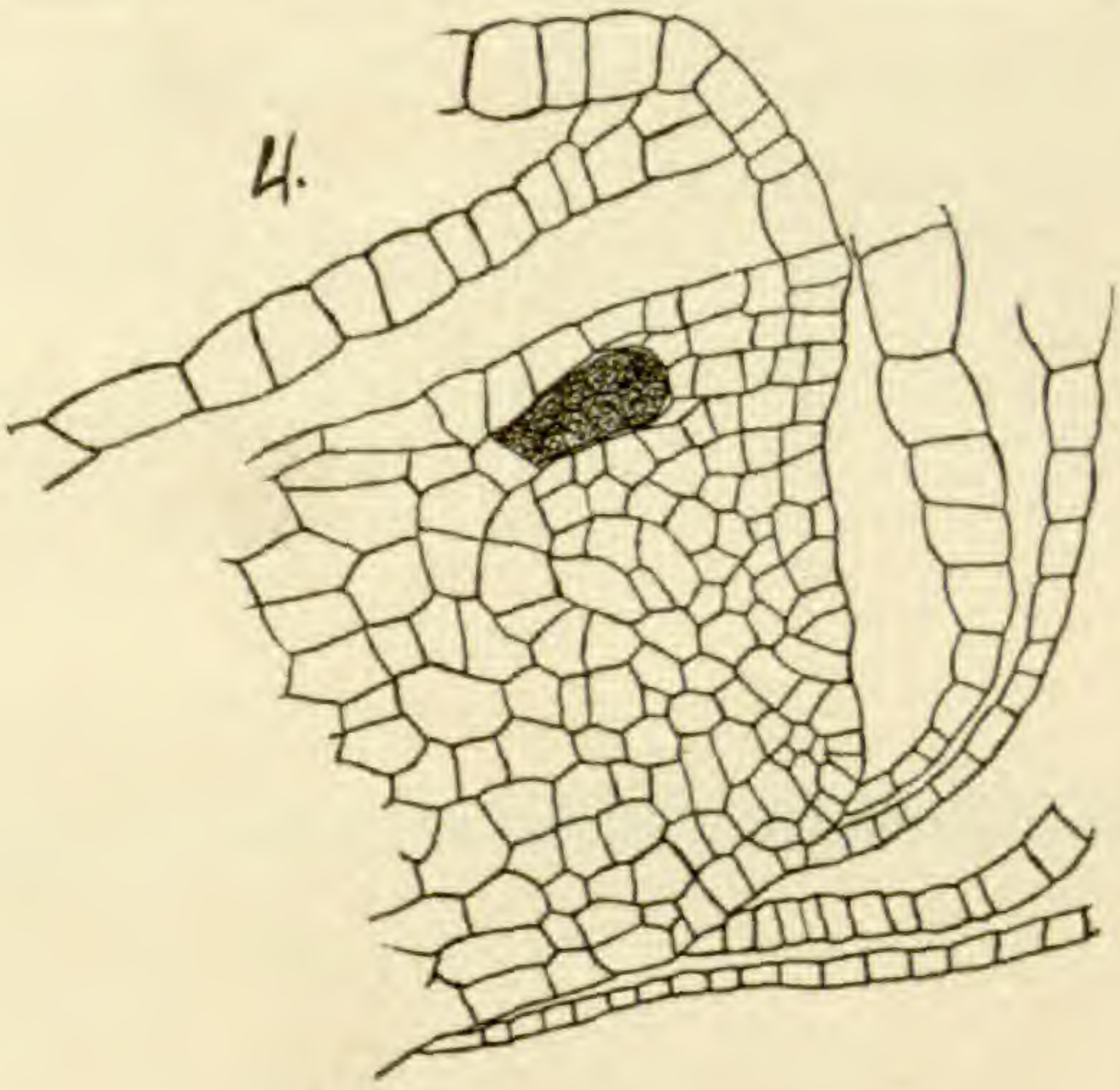
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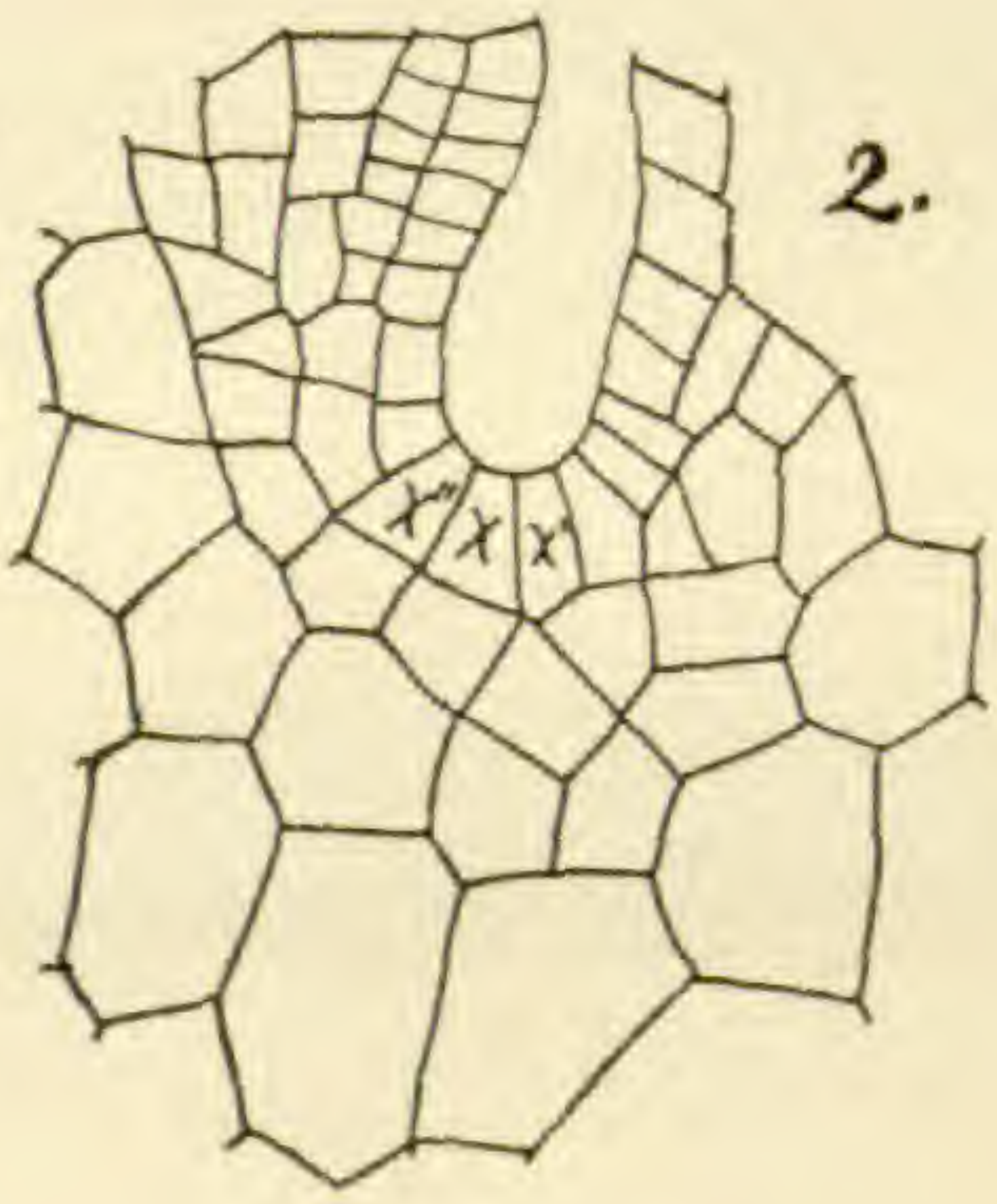
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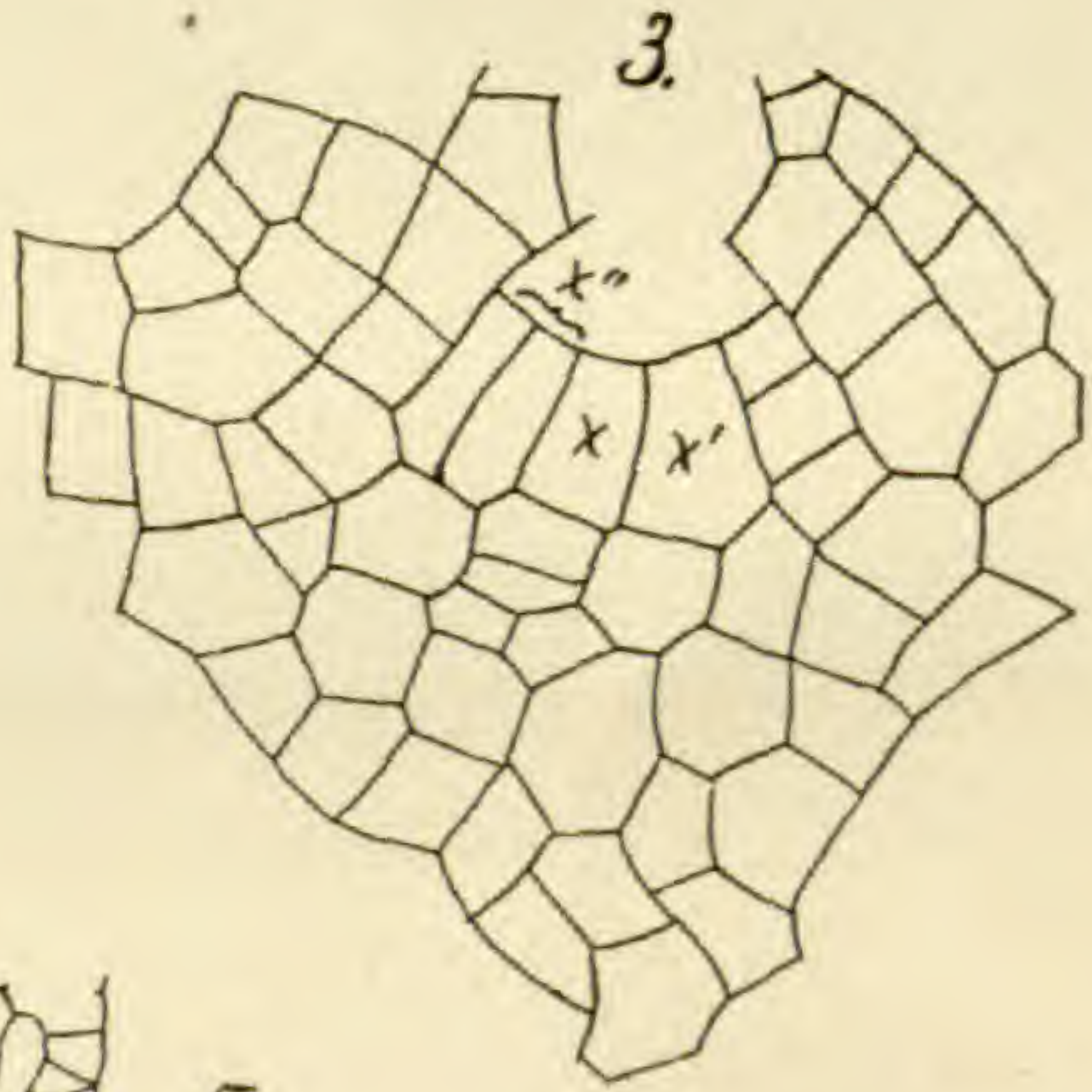
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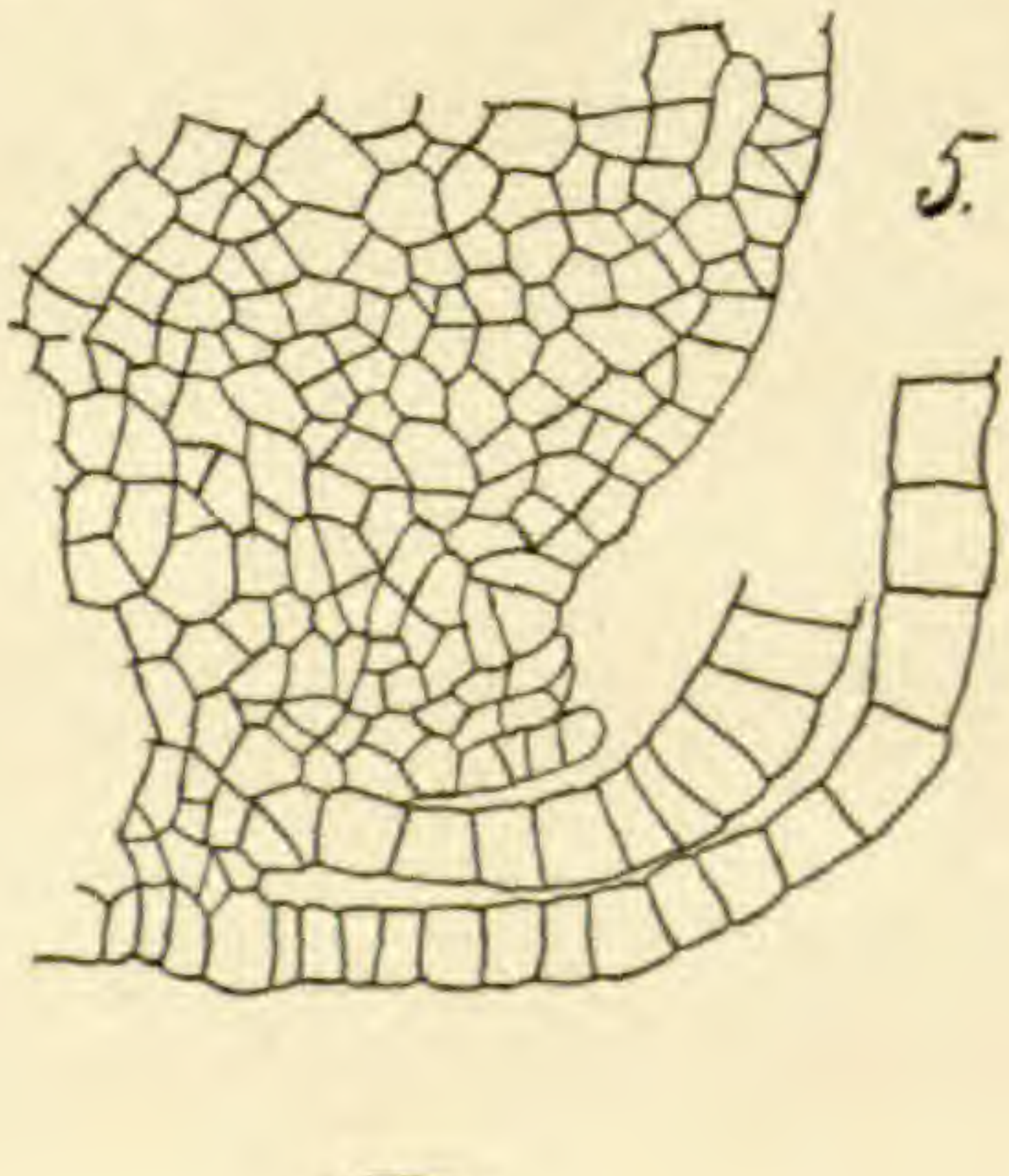
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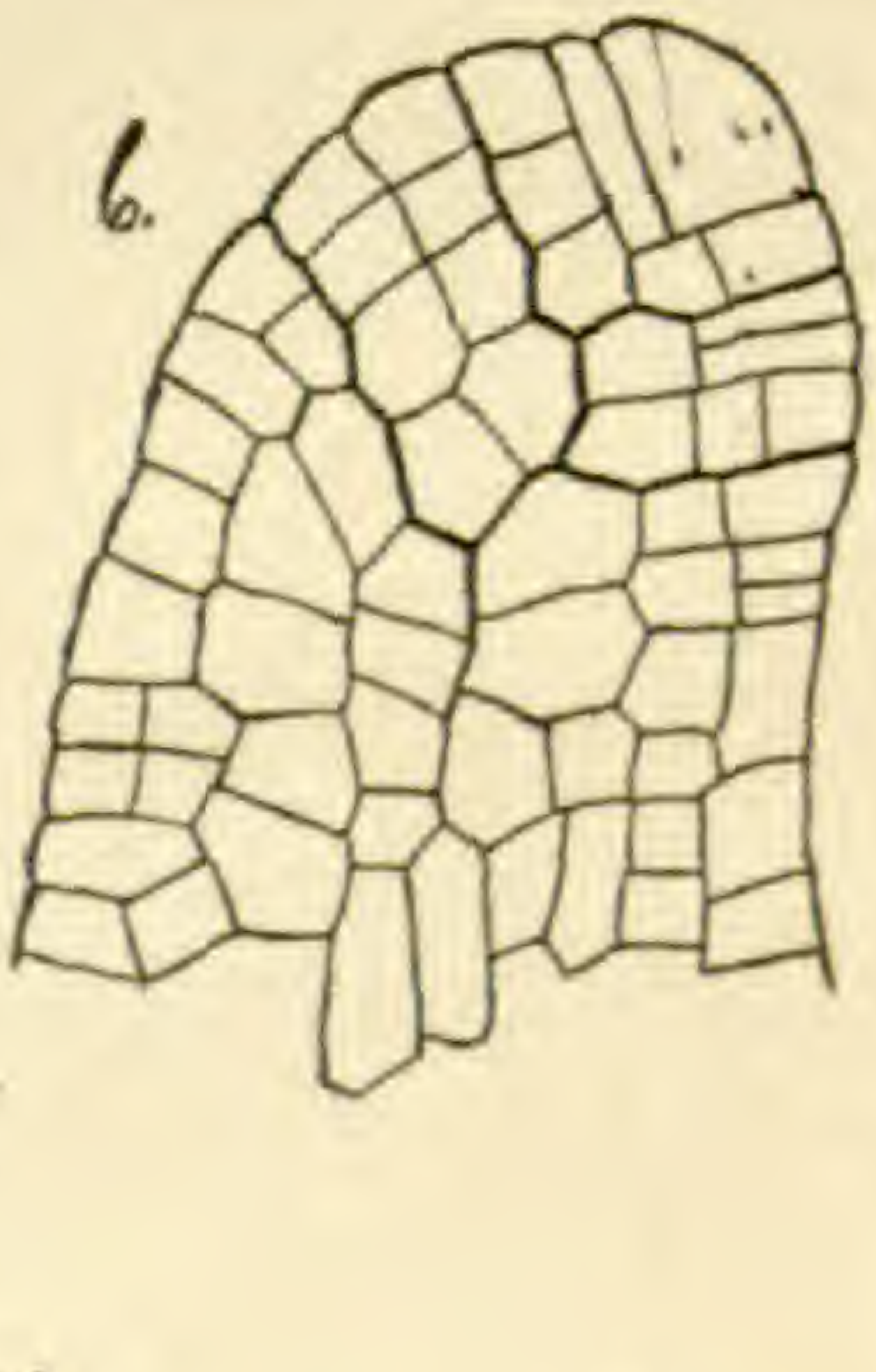
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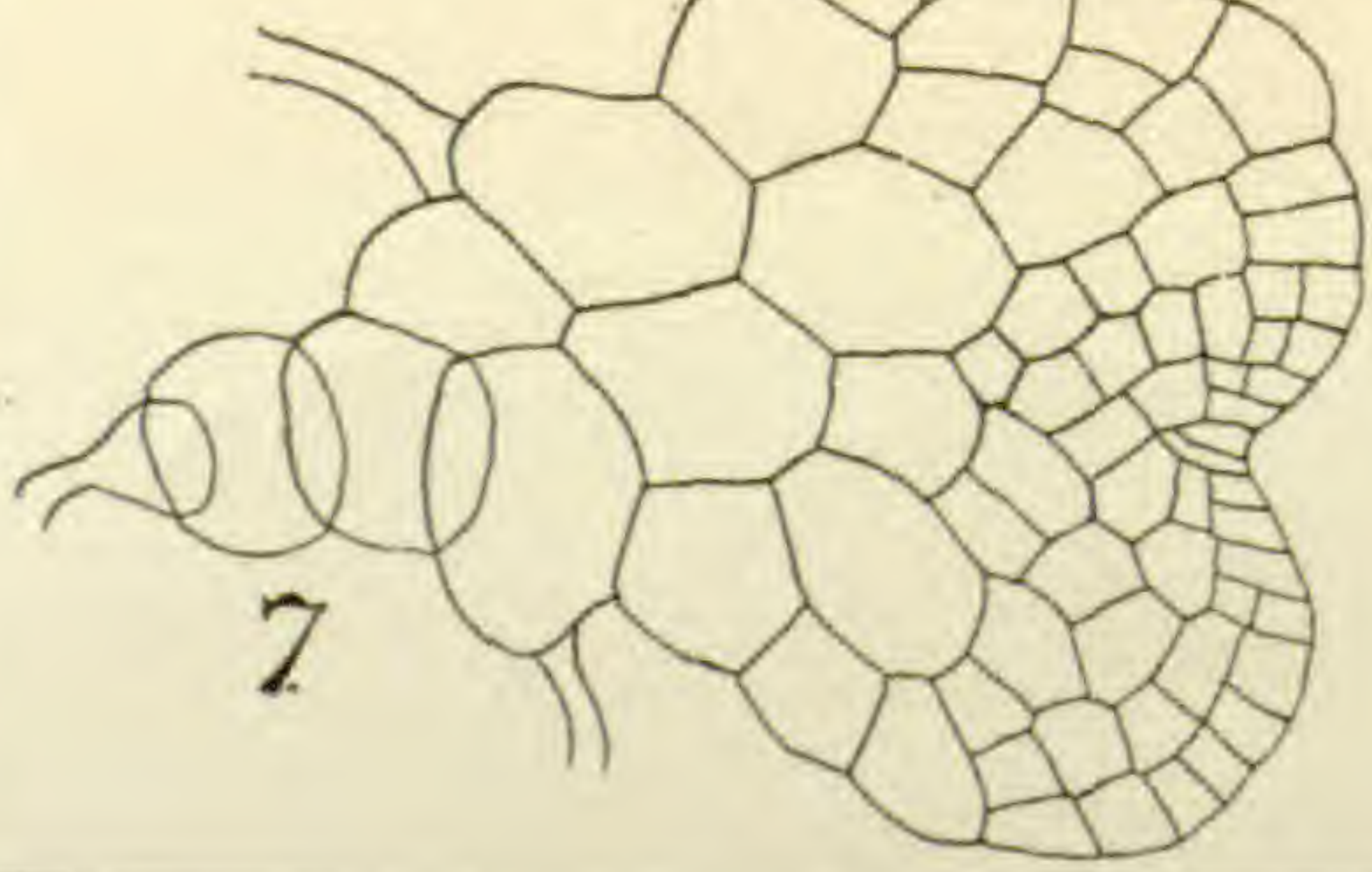
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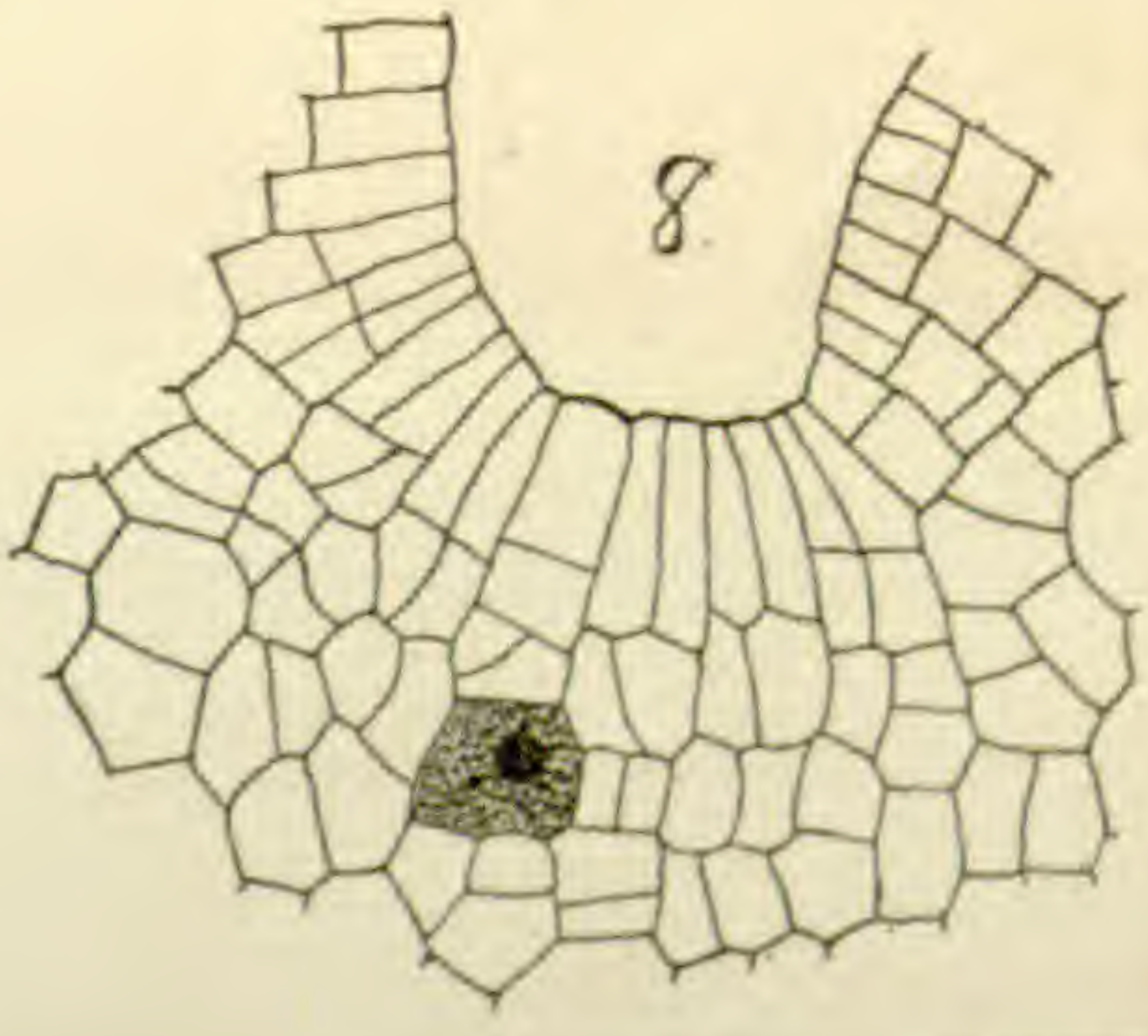
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MOTTIER on APICAL GROWTH OF LIVERWORTS.

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VOL. XVI. JUNE, 1891. NO. 6.

THE
BOTANICAL GAZETTE

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[ISSUED JUNE 15.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

Address C. R. BARNES at Cambridge, Mass., after April 1.

THE BOTANICAL GAZETTE.

A Monthly Journal Embracing all Departments of Botanical Science.

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VOL. XVI. NO. 6.—BOTANICAL GAZETTE.—JUNE, 1891.

Abnormal phyllotactic conditions as shown by the leaves or flowers of certain plants.

AUG. F. FOERSTE.

(WITH PLATE XIV.)

Sanguinaria Canadensis.—Baillon interpreted the flowers of the blood-root so as to make the petals form two decussating dimerous whorls, which by dedoublement have become whorls of four petals each. The petals of the inner whorl should therefore be directly superposed to those of the outer whorl, and the two sepals should occupy a position intermediate between two petals of the outer whorl in each case. Eichler, in his important work "Blüthendiagramme," copies this view. Unfortunately this interpretation is incorrect, as may be seen at any locality where the blood-root is at all common. For the purpose of the following notes many hundreds of flowers were examined, and the accompanying diagrams illustrate all the cases found.

It is not a rare occurrence in some, perhaps isolated, localities to find a single scale about half way up the flower peduncle, subtending a second flower. In this case the sepals of the subtended flower seem to occupy a position transverse to that of the scale. The outer set of four petals is interpreted as consisting of two dimerous whorls, the lower pair of petals decussating with the sepals, and the other pair of petals taking a position directly above the sepals. The inner set of four petals alternates with the outer set taken as a whole, and may be interpreted either as a dimerous whorl decussating with the second pair of petals, and numbering four in consequence of dedoublement, or as a whorl of four petals, showing the usual arrangement of whorls consisting of four members preceding or following dimerous whorls. The latter interpretation is shown to be the correct one by such cases as are represented by fig. 3, in which the inner whorl of petals is reduced to three, but the odd petal never occupies a median position above one of the outer petals, as it should if it represented the undivided petal of a dimerous whorl. The pistil consists of two leaves, which typically decussate with the sepals, so that the position of the sepals can be determined even when they have fallen off, which they do as soon as the flower opens. This typical arrangement of the flowers is illustrated in fig. 1. The stamens have been omitted from this diagram because nothing definite could be determined regarding their arrangement. However, the fact that the leaves forming the pistil decussate with the sepals suggested the following interpretation. The stamens are too numerous to be interpreted as a single whorl, even if dedoublement be allowed its play, especially when it is considered that *Canbya*, showing the smallest number of stamens known, six, possesses at least two whorls of stamens, and that most species demand a greater number. The blood-root must have more than two whorls in order to make the pistil leaves decussate in regular succession with the previous whorl, and with the sepals. Three whorls at least are therefore represented by the stamens, but for the present all question of dedoublement must be left undecided.

During the examination of a great number of flowers belonging to the same species it was to be expected that anomalous forms would be found. Most of these were isolated cases, such as a single sepal, evidently formed by the junction of the two ordinary sepals, fig. 2; or the more important case of sepals occupying a position directly beneath the pistil leaves, fig. 4, in which case it is necessary to assume an even instead of an odd number of staminal whorls in order to explain away their abnormal position, or rather the abnormal position of the pistil leaves. Slightly diagonal positions of the sepals are occasionally met with, but the extreme cases, such as that illustrated in fig. 10, are almost always more apparent than real, and rest upon the fact that the attachment of the sepals at their base takes up about half of the circumference of the peduncle at this point. As this base, however, represents the linear area from which the development of the sepals proceeded, a slight extension of this area to the right or the left often serves to place the indefinite median line of the sepals in a position more or less oblique to the remaining members of the flower. These exceptional conditions are mentioned only for the sake of completeness.

A far more interesting group of variations from the typical arrangement first described is that shown by the petals, and when the great frequency of such variations from the type is considered, the fact that they can all be reduced to a few series is extremely interesting. It is especially to be noted that the abnormal conditions immediately to be cited, regarding the arrangement of the petals, have no subsequent effect upon the position of the pistil leaves, and therefore can not consist in the interpolation of new whorls of petals, but must arise from dedoublement and the new conditions which dedoublement in preceding whorls often forces upon those which immediately succeed. The most common case consists in the addition of one, figs. 4 and 5, or two petals, fig. 6, to the inner whorl of petals, in such a manner that they take a diagonal position in the flower diagram, more or less approaching the transverse position which a dimerous whorl should take if it were added to the whorls already existing. That these petals are not to be interpreted in this way, but as formed by dedoublement in the nearest petals, is suggested by the unchanged position of the pistil leaves, as already mentioned. A second case consists in the removal of one, fig. 7, or two petals, fig. 8, belonging to the inner whorl of four petals, to the middle dimerous whorl, thus giving the second whorl of petals three or four members instead of two. Since this removal takes place in a direction away from a transverse line connecting the sepals the result is to leave the original petals in nearly their normal position, and to bring the added petals into a median position. That this second whorl does not consist typically of four petals in these cases is shown by the fact that the space opposite the intercalated petals is left vacant, whereas a whorl of four members should be equally distributed. According as one or two petals have been removed from the inner whorl to the middle whorl, one or two petals are added to those remaining in the inner whorl and these added petals are again placed near a transverse line connecting the sepals, but on the same side of this line.

In a third case, one, fig. 9, or both petals of the second dimerous whorl have become two by dedoublement. In that case the four petals of the inner whorl occupy as nearly as may be their original positions and one, fig. 9, or two petals are added to their number and then occupy the interval created by the separation of petals of the second whorl into two through dedoublement. In this case the addition is made precisely in line with the transverse position occupied by the sepals. The three variations from the type just described are all frequent enough to be considered characteristic of this plant. The first variation is the most common, the second, next, the third, least frequent.

A unique case is illustrated in fig. 10. Here the oblique position of the sepals is not considered of moment owing to the normal position shown by the first set of petals; it is illustrated, however, because it is the only *good* case of oblique position of sepals found during these investigations. The second set of petals consists of four members. It would be easy to say that dedoublement had taken place but then in that case two of the petals of the inner whorl should not take up a position so decidedly transverse to that shown by the first whorl of petals. Again the interpretation of the inner whorl as a dimerous whorl is excluded by the third petal which seems to make an effort to continue the greater number of members usually shown by this whorl. If this case were not unique, it would spoil all value of the previous observations.

As it is, a number of interesting facts seem to have been brought to light, not usually considered in the study of phyllotactic arrangements shown by flowers. The first of these is that new members are not added indifferently to those already existing, but follow certain laws or tendencies. The most general of these, in the blood-root, is that added members have a tendency toward placing themselves in a position more or less in line with the sepals, obliquely so in the first set of variations described, on one side of this line in the second set, and exactly in line in the third set. These positions are more or less approximately that which a new dimerous whorl would take if added to those already existing. A second fact is that succeeding whorls attempt to accommodate themselves to abnormal conditions shown by previous whorls. This finds its best expression in the intercalation of new petals in succeeding whorls in order to fill up the interval caused, apparently by dedoublement, in the preceding whorl. A third fact is that these changes in the arrangement of the petals as here instanced have taken place without producing any effect upon the position of the leaves of the pistil, and hence have not the value of newly added whorls. It is difficult to decide how far dedoublement can account for these phenomena, where its application has been quoted, or even omitted.

The slightly oblique position shown occasionally by the pistil leaves, is due largely to crowding during their later development in the bud.

The buds should be studied at as early a stage as possible. Fig. 11 represents a plant, as it was seen on Feb. 15th, during a very cold winter. The protecting scales have been removed and the larger leaf forcibly expanded. Fig. 12 shows the petals and stamens, partly enclosed by one sepal, the other having been cut away. Fig. 13 gives a slightly magnified view of the pistil at this period. It is evident from the size already attained by the organs, that flower buds should be studied for phyllotactic purposes during the summer previous to their flowering season.

Trillium sessile.—In the spring of 1882 a four leaved Trillium was found which illustrated admirably the attempt of succeeding whorls to continue or accommodate themselves to the abnormal conditions presented by previous whorls. This case is illustrated by fig. 14; the letters serve to designate the flower members but have no other significance. In the normal development of this plant there should be three sepals and three petals, in decussating whorls. The outer set of floral envelopes, marked *a*, *b*, *c*, should have been sepals, and the inner set, marked *d*, *e*, *f*, should have been petals. Instead of that, sepal *e* occupies the position of a petal, and together with sepal *c* attempts to attach itself to the whorl of four leaves as though it were an independent dimerous whorl of sepals. This attempt, however, is spoiled by sepal *a* in its usual position, but as if to maintain at least the semblance of a dimerous whorl, that part of petal *f* which lies next to sepal *c* is colored greenish like a sepal, and thus *c* and half of *f* are opposed to *a* and *e*. Further *b*, which should be a sepal, is developed as a petal, and only two of the first whorl of stamens are in existence, *b* and *c*, the third *a* being entirely absent. The second whorl of stamens and the leaves present the normal conditions. If now this case be considered as the attempt of a trimerous plant to accommodate itself to the dimerous conditions presented by the leaves, then the absence of a stamen in the first whorl can be explained. The dimerous whorl of leaves *A*, *A*, is succeeded in decussating order by a second similar whorl *B*, *B*; and this in a similar way by *a*, *e* and *c* with the adjacent part of *f*, all acting together as a simple dimerous whorl, decussating with *B*, *B*, and all having a greenish color. With this in turn the purple petals *d* and *b* are found decussating, occupying a position almost directly in line with the leaves, *B*, *B*. The trimerous character of the plant retains sufficient power to keep half of *f* deep purple as a petal should be. Decussating with *d* and *b* are the stamens *b* and *c* as a dimerous whorl. The stamen *a* which is absent, would be out of place in a dimerous whorl. The typical trimerous character is first again fully developed in the second set of stamens and is retained by the pistil leaves.

The appearance of this plant in early winter is shown by fig. 16. The seedling always starts to grow near the surface of the ground, and pushes its way laterally under the soil. Fresh roots start each year from the anterior growths of the stem, the older roots decay, and when with age the anterior roots begin to wrinkle and hence to contract, they have a tendency to pull the growing end of the Trillium deeper and deeper into the soil. In a similar way the roots of *Symplocarpus fœtidus* and *Arisæma triphyllum* draw the stems or corms of these plants deeper and deeper into the soil, but in the latter cases directly downwards. Fig. 15 shows the leaves and flower bud of fig. 16, with the protecting scales removed. At the base of the flowering stem *e* is seen a bud *f*, which represents the flowering stem of the season following *e*. The rootstock has been wrenched so as to show better the fact that the flowering stems and hence their scars *d*, *c*, *a*, and others are placed alternately on the right and on the left side of the rootstock.

Jeffersonia diphylla.—Gray has given a diagram for the flowers of the twin-leaf which makes them tetramerous, with the exception of the pistil which has only one leaf. (Genera Fl. Amer. Bor. Ill., vol. i, 34). In southwestern Ohio, where this plant is very abundant, the calyx almost always has five members, arranged rather on the plan of a spiral than that of a whorl. Four sepals were a comparatively rare exception. Two whorls of petals and two whorls of stamens were tetramerous in either case, whether the sepals were four or five in number. Typical Berberidaceæ possess an equal number of members in each of the whorls of the sepals, petals, and stamens. Perhaps it was the attempt to correlate the diagram of Jeffersonia with those of typical Berberidaceæ which led to the selection of the less frequent forms with a tetramerous calyx, as representing the typical Jeffersonia. The rarity of tetramerous forms in the calyx, and the frequency of flowers with five sepals however, makes it plausible that the five sepaled calyx still points to the original pentamerous spiral character of these whorls, which at present is no longer shown by the petals and stamens. In fig. 17, the figure given by Gray is repeated with certain variations, in order to call attention to the peculiar position of the single pistil-leaf. This leaf should fall opposite one of the stamens of the outer whorl. As a matter of fact, however, it is opposed to a stamen belonging to the inner whorl in the flowers examined.

Fig. 18 represents a subterranean bud of the twin-leaf, collected Feb. 15th with a few scales removed in order to show, at *a*, the bud from which is to develop the flowering bud two years hence. Fig. 19 shows the same bud after the removal of all the scales, in order to show the flower bud of the next season, surrounded by the leaves of the same season. Fig. 20 presents a view of this flower bud after the petals have been forcibly spread apart, showing the petals and stamens.

Rhamnus lanceolatus.—The branches of many shrubs near Dayton, Ohio, showed the leaf arrangement indicated in fig. 21, which may be briefly characterized as consisting of decussating dimerous whorls of leaves, in which the leaves, apparently belonging to the same node, are not strictly opposite to each other, but are separated by a more or less pronounced interval. This interval is in most cases not large enough to altogether destroy the effect of decussating whorls as just described. The same plants often show a typical two-fifths phyllotaxy. As a rule species of Rhamnus are described as possessing an alternate arrangement of leaves.

Fraxinus.—A twig collected at Granville, Ohio, is represented by fig. 22, but only one-fourth of its natural size. Here a branch has divided dichotomously, between the nodes *A* and *B*, but that the dichotomous character was already developed at a much earlier period is shown by the development of four leaves at the node *A*; the median two leaves should have met at the centre of the compound stem at this locality, but they have been crowded towards the exterior so that both appear in the figure here presented. That the dichotomous character was developed at an even earlier stage is shown by the position of the upper scales of the winter bud. The effect of this irregularity (best seen at *A*, upon the succeeding nodes *B*, and *C*,) is to increase the interval between the leaves belonging to the same node, already shown at *A*. This interval again diminishes at the node *D*, and ceases at node *E* in one branch and at node *F* (not figured) in the other. The lateral branches are all normal. This case is quite typical for phenomena as shown by dichotomously branching abnormal stems with opposite leaves. The small letters indicate that the leaves are situated on the side of the branch away from the observer, and these leaves are indicated by dotted contours in the figures.

Heidelberg, Germany.

A study of some anatomical characters of North American Gramineæ. I.

THEO. HOLM.

The genus Uniola.

(WITH PLATE XV.)

In the year 1810, when Brisseau-Mirbel said:[1] "Le seul moyen de perfectionner les familles naturelles, est à joindre à l'étude des caractères botaniques, celle de tous les faits relatifs à l'anatomie et à la physiologie," he hardly thought of the important change that would come about in systematic botany. The rapid increase in the number of species known made it evident that botanists must not content themselves with the mere external characters, but that others should be sought. Later appeared a series of researches especially by French and German authors, wherein an attempt was made to give anatomical diagnoses to a number of species; most successfully by Duval-Jouve, Radlkofer and Vesque. The importance of studies of that kind was very clear; they not only furnished additional and often even more reliable systematic characters, but they extended the study of anatomy into wider fields than ever before, until anatomy has become one of the most important modern lines of botanical science.

And the study of internal structure gave also a most striking illustration of the physiological life; it became easy to infer from the structure the conditions under which the plant had lived, whether in dry or moist localities, exposed to the sun or in deep shade, etc. Anatomy also rendered great help in the discrimination of species. as shown for instance by

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[1] Sur l'anatomie et la physiologie des plantes de la famille des Labiées. (Ann. du Muséum d'Hist. Nat. vol. xv.)

Vesque,[2] who proved that the anatomical characters are much more distinct and precise than the organographical ones, and that species of *Capparideæ* may be easily distinguished merely by the structure of the leaves.

To speak in particular of the *Gramineæ*, we have several works of the greatest importance upon this subject. Duval-Jouve described[3] species of Agropyrum merely by the structure of the rhizomes, culms and leaves, and he stated in his "Histotaxie des feuilles de Graminées"[4] the principal modes of arrangement of the tissues in the leaves of this family in relation to the surrounding medium.

Furthermore Hackel in his "Monographia Festucarum Europæarum" (1882), has shown the importance of the leaf-structure as to the specific differences in Festuca. The same author has also observed that most of the species of the Andropogoneæ[5] show very good anatomical characters; and finally Güntz[6] has made a special study of the leaf-structure.

These studies are, however, not only of a purely scientific, but also of a practical value, and it is easy to understand, that they must be a great help, when it is necessary to identify specimens without flowers. But that this may be done it will be necessary to know the structure of a large number of species. That such determination is possible to a certain extent will be evident if we simply recall the numerous differences in the form of the rhizomes, the sheath ligule and blade of the leaves, the vernation, etc., which, combined with anatomical characters, seem likely to give very reliable results. A few attempts have already been made in the most practical manner to identify Grasses at a stage where the flowers are not developed, for instance by Samsöe Lund[7] and Beal.[8]

We now proceed to give some anatomical sketches of our native grasses, making the beginning with the genus *Uniola*, of which five species are enumerated from this country, namely:

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[2] Essai d'une monographie anatomique et descriptive de la tribu des Capparées. (Ann. d. Sc. Nat. Botanique, ser. 6, vol. xiii, 1882).

[3] Étude anatomique de quelques Graminées, et en particulier des Agropyrum de l'Hérault. (Mém. d. l'Acad. d. Montpellier, vol. vii, 1870).

[4] Ann. d. Sc. Nat. Botanique, ser. 6, vol. i. 1875.

[5] A. et C. De Candolle: Monographia Phanerog. Prodromi; vol. vi, 1889.

[6] H. E. M. Guentz: Untersuchungen ueber die anatomische Structur der Gramineenblaetter, etc. Inaug.-Dissert. Leipzig, 1886.

[7] Vejledning til at kjende Græsser i blomsterlös Tilstand. Kjöbenhavn, 1882.

[8] W. J. Beal: Grasses of North America for farmers and students, 1887.

U. latifolia Michx., *U. gracilis* Michx., *U. nitida* Baldw., *U. paniculata* L. and *U. Palmeri* Vasey.

Uniola latifolia Michx.—A series of anatomical sections have been figured on plate xv. These sections have been taken from the middle part of a completely developed leaf.

As regards the structure of the epidermis of the superior face (fig. 1), this does not show anything of particular interest. The cells of which it consists are of different size and shape, forming longitudinal lines in the blade, and the differences depend upon situation.

The large bulliform cells[9] lie in broad lines, covering the green parenchyma between the large nerves, and they form about six rows of rectangular, uncolored cells. Sometimes and especially toward the midrib they are interrupted by prominent and roundish groups of cells, surrounding the base of long, stiff and pointed unicellular hairs. Bordering on each side of these strips of bulliform cells there are some rows of smaller, rectangular cells, the side-walls of which are more or less undulated. They cover a small part of the green parenchyma. The stomata are to be observed here, and they form only a single line on each side of the groups of bulliform cells, while the other lines possess numerous short, very thick-walled and pointed expansions. In alternation with these thorn-shaped expansions are also to be seen short, unicellular, slightly curved and obtuse hairs. Besides these rows of epidermis cells there are still a few, from one to five, rows which cover the stereome. These consist of very short and narrow cells, the walls of which are strongly thickened.

Comparing the epidermis of the superior face, described above, with that of the inferior face, we see the following differences. The bulliform cells are entirely absent, as well as the long hairs; the short hairs are on the contrary also to be observed here together with the thorn-shaped expansions, which are still more numerous on this face. The stomata show the same distribution and number as mentioned before.

We now examine a transverse section of the whole blade, which, compared with similar sections of the other species of the genus, shows differences worthy to be considered as specific. Figs. 2 and 3 represent respectively sections from the middle part of the blade and a small lateral part, adjoining this. The median nerve (fig. 2) does not occupy the whole carene, but merely forms a centre for the entire system of the mestome. It is the strongest one, containing the farthest developed leptome and hadrome, and is supported by the largest group of stereome, but does not, however, connect the superior face of the blade with the inferior. The carene itself consists of two groups of mestome-bundles, one on each side of the median line, and these are all separated from the superior epidermis by an immense tissue of uncolored parenchyma. The uncolored parenchyma preponderates then in this part of the blade and is partly separated from the superior epidermis by six relatively strong bundles of stereome. In the lateral parts of the blade it is restricted to a single stratum inside the rows of bulliform cells.

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[9] Duval-Jouve; Histotaxie des feuilles de Graminées l. c. p. 316.

As to the mestome bundles, there are in this species about seventy on each side of the median nerve, and they represent three different degrees of development. The largest (fig. 6) are characterized by having a layer of very thick-walled parenchyma between the leptome and the hadrome, completely enclosing the first, and both the leptome and hadrome are here strongly developed; furthermore by being supported by two large groups of stereome, above and below, just excepting the bundles of the carene, where no stereome is in connection with the superior face of the mestome. The second degree of development (fig. 8) shows smaller bundles of stereome above and below, and the leptome is not separated from the hadrome by any layer of thick-walled parenchyma; there is merely a semicircular layer of thick-walled parenchyma bordering on the leptome side. Fig. 9 illustrates one of the smallest mestome bundles, completely imbedded in the mesophyll and without any groups of stereome; there is no thick-walled parenchyma to be observed here within the proper parenchyma sheath.

As regards now the arrangement of these three different forms of mestome bundles, this is as follows: The two larger are constantly situated on each side of the groups of bulliform cells, while the smallest, those of third degree, are restricted to a position just between the bulliform cells and the inferior face of the blade. It must be remarked, however, that this arrangement does not include the bundles of the carene, for the reasons mentioned above. As to the number of these three forms, the smallest ones are the most numerous in the whole blade. It may be expressed diagramatically as follows:

$A^{*}-C-B-C-A-C-B-C-A^{1}-C^{1}-B^{1}-C^{2}-B^{2}-C^{3}-A^{2}$, where A indicates the largest bundles of mestome, the median being A*; B shows those of second and C those of third degree. A^1 corresponds then to the strong bundle in fig. 2, marked in the same manner, and it is situated below the outermost group of stereome in the figure, separated from this by the uncolored parenchyma. C^1 is the first bundle situated between the first group of bulliform cells and the inferior epidermis. The disposition of the groups of bulliform cells may be seen in the same formula, namely, between A^1 and B^1, B^1 and B^2, B^2 and A^2, just above the C's, beginning at C^1. This formula may not be strictly constant, but it gives, however, the general features concerning the relative number and arrangement of the mestome bundles.

Besides the proper parenchyma sheath of green or sometimes uncolored cells, never wanting in the mestome-bundles of the Gramineæ, some of these bundles show the presence of another sheath or at least a layer of thick-walled parenchyma inside this. A distinct thick-walled sheath is shown in fig. 6, enclosing the leptome, and we are able to trace it also in the small bundles (fig. 8), though not in the smallest ones (fig. 9). Schwendener[10] has called attention to the presence of this parenchyma, which in several instances looks very much like what the same author has called a "mestome-sheath." But in Uniola latifolia there is no mestome-sheath; for the reaction with concentrated sulphuric acid proved that the thick-walled cells, whether they form a closed sheath or not, merely belong to the mestome parenchyma. Furthermore, if it had been a mestome-sheath it would also have been present in the smallest bundles. The proper parenchyma sheath showed in some instances (fig. 7), a thickening of the cell-walls, especially in the cells which border on the leptome side.

Now, concerning the arrangement of the stereome-bundles, we have already seen in the description of the mestome that the arrangement is nearly identical. There is one group above and below the two largest mestome-bundles, but none at the smallest ones, and there are merely six isolated groups on the superior face of the carene, which are not in contact with the mestome. Besides there is also one rather strong group in each of the outermost parts of the blade, the margins.

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[10] S. Schwendener; Die Mestomscheiden der Gramineenblaetter. (Sitzungsberichte d. wiss. Acad. Berlin, 1890).

The mesophyll in this species forms in a transverse section an interrupted line, being in immediate contact with the epidermis of the inferior face, except where it is interrupted by the large mestome-bundle of first or second degree. It is on the contrary almost entirely separated from the superior epidermis by the stereome and the uncolored parenchyma under the bulliform cells. The mesophyll showed a rather firm structure without any lacunes.

These are the general features of the anatomical structure of the leaf of Uniola latifolia, and it will be shown in a following paper that these characters as compared with the corresponding ones in the other species are of truly specific rank.

U. S. National Museum, Washington, D. C.

EXPLANATION OF PLATE XV. — *Sections of the leaf of Uniola latifolia.* Fig. 1. Epidermis of the superior face, ×240. Fig. 2. Transverse section through the middle part of the blade, the carene. The black part of the figure represents the mesophyll, which borders on the large uncolored tissue of parenchyma. The mestome bundles with their parenchyma sheaths and groups of stereome are to be seen in the mesophyll. Six rather large bundles of stereome (*S*) are to be seen on the superior face, the concave part of the carene. ×75. Fig. 3. Transverse section through a part of the blade, next to that figured in fig. 2. Five groups of the large bulliform cells are to be seen at *B*. ×75. Fig. 4. Thorn-shaped expansion from the superior face, ×320. Fig. 5. Hair from the inferior face, ×320. Fig. 6. Transverse section of one of the largest mestome bundles of the carene, showing the partly green parenchyma sheath, the leptome above and the hadrome below. The leptome is surrounded by a sheath of very thick-walled mestome-parenchyma bordering on a group of stereome. ×560. Fig. 7. Transverse section of a small mestome bundle, that next to the midrib. Three cells of the green parenchyma sheath show a distinct thickening of the cell wall. A group of stereome borders on the leptome side. ×560. Fig. 8. Transverse section of a small mestome bundle from one of the lateral parts of the blade. There is a horseshoe-shaped sheath of thick-walled parenchyma on the leptome side, and the proper parenchyma sheath shows four uncolored cells, while the other ones contain chlorophyll. ×560. Fig. 9. Transverse section of a small mestome bundle, not far from that figured in fig. 8. The parenchyma sheath is perfectly green, and there is no thick-walled parenchyma inside this. ×560.

On the organization of the fossil plants of the Coal-measures.[1]

DAVID WHITE.

[The following review contains so much of anatomical importance that we give it this more conspicuous place.—EDS.]

The observations recorded in these three memoirs, while confined chiefly to types, most of which have been treated more or less in the preceding parts, are hardly less remarkable for the information they bring to bear on the mode of the formation of the medulla and the development of exogenous growth in certain Carboniferous cryptogams, than for the proof they furnish of the existence of an exogenous growth among the Carboniferous ferns.

Part XV throws new light on the structure of the rhizomes and petioles belonging to Corda's genera Zygopteris and Anachoropteris, as recognized by Renault, Stenzel, and others, which Williamson shows to be generically equivalent. For these he prefers the name *Rachiopteris* proposed by himself in 1874 (Pt. VI, p. 677) "for a considerable number of these objects which appeared to be either rhizomes or petioles of ferns," for the reason that an examination of the structure of living ferns, classified by their fructification, shows that "no classification of fossil ferns based solely on the characters revealed in transverse sections of their petiolar bundles can be of value." Neither Prof. Williamson nor several other recent authors, seems to be aware of the coincident fact that Dawson in 1861 (Q. J. G. S. L., xviii, p. 323), with equal appropriateness, proposed the new genus *Rhachiopteris* "to include such Devonian stipes as indicate the existence of distinct species of ferns, of which the fronds have perished." Schimper does not seem to have known of Dawson's genus when he established his *Rhacopteris* (Traité, I, 1869, p. 481), based on the character of the fronds. Incognizance of these facts and the too common mis-spelling of the generic names have caused much confusion in the nomenclature.

To a fine species, from the Halifax deposits, related to Renault's *Anachoropteris Decaisnii*, Williamson gives the name *Rachiopteris Grayii*, while the section of a hairy branching stem or rhizome, also from Halifax, resembling in many respects the young branches of living Marsileæ, is named *R. hirsuta.* Two roots, from Halifax and Oldham, showing tructure minutely, are called *Rhizonium verticillatum* and *R. reticulatum;* and a third, equally remarkable in structure, whose features resemble those seen in the cortex of *Asterophyllites Williamsonis*, is named *R. lacunosum.* The examination of new specimens of *Calamostachys Binneyana* has enabled the author to fill two gaps in the knowledge of the structure of that interesting form of strobilus, viz. the distribution of the vascular bundles of the central axis, and the peripheral termination of the sporangiophores. Sections of a fertile strobilus through the latter show a thickened distal end, occupied by clusters of tracheids concentrated in the region where each sporangium is organically attached, showing "that these peripheral terminations of the sporangiophores approach even nearer than they were previously known to do to those of the living Equisetum, in corresponding parts of which similar clusters of tracheids exist."

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[1] WILLIAMSON, W. C.—On the organization of the fossil plants of the Coal-measures. Phil. Trans. Roy. Soc. London. Part XV, vol. 180 (1889) B. pp. 155–168, pl. i–iv. Part xvi, l. c., pp. 195–214, pl. v–viii. Part xvii, op. cit., vol. 181 (1890) B. pp. 89–106, pl. xii–xv.

Part XVI is devoted to studies of the mode of branching, the formation of the medulla, and the method of exogenous growth as seen in a number of Lepidodendra, several of which are here first described. The author considers the ordinary mode of branching in this genus to have been dichotomous, with a perfect dichotomy of the medullary vascular cylinder, but that only a segment was cut off from that vascular bundle when the branch was of a special kind, "characterized by an arrested development," such as is represented by the tubercles of *Halonia*, or the scars of *Ulodendron* in which the arrested branches supported Lepidostrobi, both of the latter genera being only "conditions" of various Lepidodendroid genera.

He finds that the germs for the gradual formation of a medulla in the center of a vascular bundle which previously contained no traces of cellular structure were furnished by the procambium from which, in the youngest twigs, the entire bundle originated. The first one or two medullary cells, formed in the centre of the bundle of tracheids, increased by the ordinary meristemic process of enlargement and fission. The internal tension produced by the enlargement of the medullary cellular expansion caused the vessels of the vascular bundle to form a ring increasing in size, the number of vessels also increasing correspondingly and changing their respective positions. This meristemic process is repeated "until the medulla and its surrounding vascular ring attain to their ultimate magnitude — a condition which was probably coincident with the first appearance of the more external exogenous zone." It is probable that the new vessels are produced centrifugally, on the cortical side of the vascular cylinder, though it is possible that some of the young medullary cells assumed a procambial form and were converted into vessels. In any case he considers that the enlargement of the medullary vascular cylinder is mainly, if not wholly, effected "through the internal tension occasioned by the subsequent multiplications and expansions of the medullary cells — a condition that has no existence among the exogenously-grown trees now living." He regards the occurrence of an exogenous growth at some time in the development of all the Carboniferous Lepidodendra as more than probable.

The existence of an exogenous growth among the arborescent Lycopods, Gymnosperms, and Calamarias has long been known. Part XVII of these memoirs has the important office of making known the existence of an exogenous development among the Carboniferous ferns. The anticipation expressed by the author, in Part IV, that *Dictyoxylon* (*Lyginodendron*) *Oldhamium*, there described as belonging to the paleozoic Proto-gymnosperms, might be identical with the petioles described in the same memoir as *Edraxylon*, and later (Part VI) as *Rachiopteris aspera*, is now confirmed, and the two are conclusively proved to be trunk and petiole of the same plant. The study is thorough; the steps in the growth of the petiole from the trunk are observed with the accuracy and minuteness of detail characteristic of the author's former memoirs. The pairs of vascular bundles so characteristic and conspicuous in the middle cortex of *L. Oldhamium* are shown to pass outwards through the outward cortex and become the tracheal bundles of the petioles of *R. aspera*. The clusters of tracheæ, in the small stems, which at first formed one united axial cluster, are separated, the space thus produced at the center being occupied by a steadily expanding parenchymatous medulla. This process is accompanied by a corresponding enormous increase in the number of the vascular laminæ, the inner extremities of which, though commencing their growth at different periods of life, all start from the medullary border of the vascular zone and extend to the periphery. Among the numerous specimens examined the number of laminæ varied from 44 in a small specimen to 1120 similarly arranged laminæ in a larger one. The transition between the petiolar and trunk structures was not only observed in all stages from many fragments, but specimens were studied in which stem and petiole are organically united, demonstrating not merely that *Lyginodendron Oldhamium* is a true fern, probably belonging to the Sphenopterids, but also that the stems of some, at least, of the Carboniferous ferns "developed their xylem or vascular structure exogenously through the instrumentality of a meristemic zone of the innermost cortex, which practically must be regarded as a cambium layer."

Additional observations on the growth of *Heterangium Grievii* are contributed, without establishing its true affinities, though it seems likely eventually to prove to be a fern. The discovery of the vegetative organs of *Bowmanites (Volkmannia) Dawsoni* and the study of their structure shows an organization generically identical with that of the Asterophyllites described by the author in a former memoir, and the plant described by Renault as *Sphenophyllum Stephanense.* The triangular central vascular axis is the most conspicuous character in the three types. Bowmanites, though it can be regarded as generically identical with the Sphenophylla whose fruits have been definitely correlated, is most strongly allied to the Sphenophylloid type. Williamson calls attention to the fact that evidence is being obtained of the existence of Carboniferous plants whose branches bore both Asterophyllitean and Sphenophylloid leaves (a view supported by Stur's researches among the Schatzlar Calamariæ), and that Sphenophyllum and some forms of Asterophyllites should be united in the same genus. All these types, however, he regards as belonging to the great family Calamariæ, of which Equisetum is "a poor, feeble and degraded member," rather than the central type.

Washington, D. C.

On the relation between insects and the forms and character of flowers.

THOMAS MEEHAN.

Surely all must concede that those who are industriously collecting and recording facts in relation to the visits of insects to flowers are engaged in a work of great value to science. To my mind one of the weaknesses of these observers is to attach too much importance to their work. In the enthusiasm of useful discovery, it becomes difficult to believe that the facts noted by other observers can have a value equal to our own, and we must deal leniently with the friends whose weakness induces them to belittle or ignore the work of others in parallel lines. It will do no harm, while so much is being claimed for the influence of visiting insects on the form and general behavior of flowers, to note a few propositions which have been presented and proven during the past few years, and in which I think my own work has had a place, which surely show that insects are not the all important factors in many given results credited to them.

1. Many changes in the forms of flowers are attributed to the insect's touch, and it is claimed that modification has slowly proceeded through the ages responsive to these insect habits; but it is surely not denied, at this day, that change does not occur by slow modification, but by leaps, and often by leaps of a gigantic kind. Insects can do nothing here.

2. It has been shown that in the earlier stages of fertilization there is no reason why a flower may not be indifferently of either sex, and that the final determination of this matter is a question of nutrition, with which an insect can have little to do.

3. There is no question that a flower proterandrous in one district or season may be proterogynous in another—that it is wholly a matter of meteorological influence, in which an insect has no place.

4. Fertility in plants is not wholly a matter of pollination. Some plants are barren though the pollen tubes can be traced to the ovules, and myriads of fruit resulting from perfect fertilization fall in an early stage. Nutrition is of as

much importance as fertilization by the pollen in an early stage[1] in securing ultimate fruit.

5. The floral parts are modified leaves — modified by a process that lessens their vital power — and color in these floral parts is an attribute of weakening vital power, having no relation to the visits of insects.

6. Plants wholly dependent on insects for fertilization are all perennials. An innumerable number of the flowers of these plants fall unfertilized, and but for their being perennials, many species so dependent would have long since disappeared.

7. All annuals, though in some cases so arranged that cross-fertilization may occur, can self-fertilize when cross-fertilization fails. In fact annuals are in a general sense self-fertilizers. In almost all cases annuals have every flower fertile.

8. Flowers do not abhor own-pollen, as the proposition once enthusiastically ran. No flowers are so truly fertile as those of the cleistogene class, while the nearly allied class of plants which fertilize before the corolla expands are also certainly fertile. The list in these two classes has grown so large as to render the proposition cited untenable.

9. It is conceded now that variety or variation is an essential condition in the order of things, — and that there is no more reason why special forms or colors in flowers should be made dependent on the accident of an insect's visit, than are forms and colors of minerals. The forms and colors of flowers must have had an extensive range had not an insect appeared on the stage.

We must not forget that what we call the kingdom of nature is a vast organization in which a great number of smaller and inferior powers are working apparently independently, but actually in co-operation or accord with the greater ones. No one phenomenon can be fairly placed to the credit of any one direct cause. The forgetfulness of this fact leads to many an error in our theoretical deductions. At any rate the unchallenged propositions I have enumerated, show how many things have to be considered before we accept the wide generalizations presented by those who tell us of the relation of insects to the forms and characters of flowers.

Germantown, Phila.

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[1] This proposition is commended to the author of the note on Cephalanthus, at p. 66 of this volume.

BRIEFER ARTICLES.

A suggestion on the proper terminology of the spermaphytic flower.— Faults in botanical terminology are, as in all other branches of science, very numerous. The more striking ones may perhaps be classed under a two-fold grouping— those which represent actual differences of opinions among authorities or different methods of naming the same phenomenon and those which indicate the *vis inertiæ* of the science on account of which universally abandoned notions are perpetuated by the retaining of the unmeaning or misleading words which were applied when erroneous ideas regarding anatomy, development and homologies were the only ones known to botanists. Of the first mentioned group the words Phanerogam or Gymnosperm are good examples. No one supposes that the Phanerogams are really the plants in which fertilization is distinct — as was the notion of Linnaeus. The word to-day may be applied to the group of plants which produce embryos and pollen-tubes — the Embryophyta Siphonogama of Engler, or it may be defined as the group which produces seeds and suspensors, or as the group in which one may distinguish the three embryonic layers of Hanstein and secondary endosperm. It makes no difference; the word is good enough if one defines it correctly. Whether one says Anthophyte, Spermaphyte, Seed Plant or Phanerogam is unimportant. So whether one defines the Gymnosperms as seed-plants with apical cells as Van Tieghem defines them, as Archispermous flowering-plants after Strasburger, as polyembryonic seed-plants, as seed-plants with suppressed secondary endosperm, as flowering plants with uncompressed floral axes; whether one accepts the view of Eichler regarding the homology of the cone or that of Baillon is of no importance. In any case the words are correct enough and express very well what one wishes to express when one uses them.

The other group of erroneous terms can not be dismissed so lightly. One of the most confusing places for the novice in botany is that part of the ordinary text-book which treats of the flower. The old and mistaken notion that flowers contain male and female organs took such hold of the authors on botany that, to this day, although it is about fifty years since the idea was abandoned, one can find nothing but confusion in the terms which are applied to the various phases and parts of flowers. Gray[1] speaks of hermaphrodite, unisexual, male and female flowers; Sachs of hermaphrodite flowers, of sexual organs — meaning stamens and pistils[2]; Gœbel of unisexual flowers and hermaphroditism, of male and female flowers[3]; Bessey of the female flower of Gymnosperms[4]; Luerssen of the male and female organs, of male and female flowers (die Geschlechtsorgane, männliche Blüthe, weibliche Blüthe, etc.)[5]; and one can hardly find an author of note who does not thus perpetuate in his terminology notions which he must certainly have abandoned and desires to guard others against adopting.

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[1] Structural Botany p. 191.

[2] Physiology of Plants, Eng. tran. p. 789 and elsewhere.

Now in this case there seems to be no excuse for such looseness. If biology is to be an exact science it should use its terms as the chemist or physician does. Acids must not be called bases, magnetism must not be called heat, electricity must not be called thermodynamics. Let it be remembered that reproductive cells are of two kinds, those formed by division of an existing plant-body, namely spores, and those formed by fusion of gametes, namely eggs. A plant which produces pollen-grains, embryo-sacs, conidia or any kind of spore is a spore-bearing plant or sporophyte (in the widest sense); a plant which produces gametes (whether they be isogametes as in *Ulothrix*, *Mucor*, *Syncephalis*, or spermatozoids and eggs—both or either) is a gamete-producing plant or gametophyte. We may then use our terms correctly as follows:

Gametophyte group.	*Sporophyte group.*
Hermaphrodite.	Monoclinous, diclinous.
Unisexual, bisexual.	Monoecious, dioecious.
Male, female.	Staminate, pistillate.
Spermatozoid, egg.	Microspore, macrospore.
Fertilised egg.	Macrosporophyll, microsporophyll.
etc.	etc.

We may speak of hermaphrodite, unisexual, male prothallia of ferns, if we like, but we should certainly say monoclinous, monoecious, microsporophyllous flowers. The general adoption of some uniformity in the applying of names to flowers and parts of flowers would not only make all discussions of them clearer but would not do learners the injustice of forcing upon them the very ideas which it is deemed important they should not get.—CONWAY MACMILLAN, *Minneapolis, Minn.*

Curious case of germination in Citrus decumana.—I received a few days ago from Prof. Le Baron R. Briggs, of Harvard University, half of a fruit of *Citrus decumana* on the cut surface of which was a seed which had begun to germinate. The hypocotyl was, at the time, a quarter of an inch long, and the well formed cotyledons had already separated, showing the plumule which had just begun to expand. What is to be noted as curious in this case, is the fact that the seed had germinated in the intact fruit, and the cotyledons and plumule were dark-green in color. Normal germination of seeds under such circumstances is so rare that one naturally is lead to suspect that some mischievous person had inserted a germinating seed into the fruit after it had been cut open. This possibility is excluded by the positive statement of Prof. Briggs, that the fruit was brought to his table perfectly intact, that he saw it cut open, and at once noticed the green seedling which was in the center of the fruit, just where the cut was made, and escaped injury except that a small part of one of the cotyledons was cut away by the knife. The testimony is so positive that suspicion of deception is excluded, and we must believe that the seed actually germinated and bore green cotyledons and plumule while enclosed in the sound fruit.—W. G. FARLOW, *Cambridge, Mass.*

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[3] Outlines of Classification and Special Morphology, Eng. tran. p. 347.

[4] Botany, 5th edition, p. 397.

[5] Systematische Botanik ii, 193.

Coursetia axillaris, n. sp.—Shrub or small tree (?), the younger parts pubescent : leaves small, odd-pinnate; leaflets 3 to 5 pairs, reticulated, almost glabrous above, somewhat pubescent below (as is also the rhachis), 3 to 8 mm. long, obtuse, the lower pair orbicular, the upper pairs obovate : flowers axillary, on peduncles 4 to 10 mm. long : calyx pubescent, 4 mm. long, with 5 broad equal teeth (the 2 upper ones high connate): petals about equal in length; vexillum very broad (12 mm.) and reflexed; wings oblong: vexillary stamen free; the others equal: style slender, very hairy above the middle: ovary 2 to 8-seeded: pod 2-valved, glabrous, 3.5 cm. long, with lobed margins and on a broad stipe.—San Diego, Texas, April, 1891, (*G. C. Nealley*, 16). This plant is interesting as being an intermediate form between two closely related genera, Coursetia and Sabinea. While the general characters are those of Coursetia, the inflorescence is that of Sabinea. In habit and pods it is nearest C. glandulosa of Arizona and Mexico.—JOHN M. COULTER, *Crawfordsville, Ind.*

EDITORIAL.

A MOVEMENT has begun in Indiana, which may lead to good results. A teacher's "reading-circle" has been organized for some years, containing, it is claimed, 30,000 members. Different subjects are selected each year, and an executive committee directs the proper books to be read. It has been found very profitable to publishers to secure the sale of 30,000 copies of any book they own, and to furnish with the book an "outline of study." It is not our province to speak in general of the books used, but since botany has been made one of the subjects of the present year, we may be justified in commenting upon the character of the work proposed. We are free to say that if the whole range of botanical literature had been searched, no more unsuitable book could have been found to give these teachers any conception of modern botany.

IT WAS with a feeling of curiosity that we have watched for some of the results; and they have come speedily enough in the shape of numerous letters from these struggling teachers. Their general opinion seems to be that if this is botany, they want no more of it. They are not to be blamed, for feeding on husks is never an inspiring diet; it only inspires a strong desire to leave the country of husks as speedily as possible. It is as if they were studying English literature, and instead of being directed to a study of the great masterpieces were told to memorize an English dictionary. In the " outline of study " which accompanies this glossary (by courtesy called a "botany"), a ludicrous attempt has been made to get into the current of laboratory methods. By a strange fatality, every plant whose examination is called for either does not grow in Indiana, or is to be secured months away from its natural time of appearance.

THE PROMINENT result of all this has been to disseminate a wide feeling of disgust for one of the most delightful of sciences; and the study of botany in the schools of the state has received a terrible backset. The possible movement for good, referred to in the opening sentence, is one just inaugurated by the Indiana Academy of Sciences, a thoroughly organized and vigorous body. The schools of the state and the scientific men are both so completely organized, that the influence of one can be easily brought in contact with the other. A committee of the Academy has been appointed to devise measures for securing a better grade of science teaching in the schools, and to attempt to counteract the influence of "reading circle" science. As the committee has been organized, not simply to draft resolutions, but to enter upon a practical campaign of hard work, we may look for some good results.

IT HAS OCCURRED to us that it would be well for scientific men all over the country to attack this problem in a more organized way. It is easily seen that as students pass from our well-equipped laboratories and become teachers in these schools, the leaven of scientific methods is slowly working its way through the mass. But as yet, the mass is so vast, and the leaven is so small, that organized effort on the part of leaders in scientific work might hasten the movement.

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THE SECOND part of Prof. Conway MacMillan's paper on "the three months course in botany" appears in *Education* for April. Had we anticipated another installment, we should have avoided a premature criticism, even inferentially, of his views, which are shown to be essentially in accord with those of the GAZETTE, ante, p. 120.

CURRENT LITERATURE.

Trelease on Epilobium.[1]

This is one of the most complete and satisfactory monographs we have seen. The genus is one of most perplexing character, for the species intergrade interminably. The author has wisely restrained himself from acknowledging as species all the forms that have been described as such, but he has felt compelled to publish several new ones. Not only is the geographical distribution of the species briefly considered, but the biological features connected with means of vegetative propagation, pollination, and dissemination, are noticed with that wealth of information and literature known to be in the possession of the author. The range is that of Gray's Synoptical Flora, here shown to contain 38 species of Epilobium. The new species are E. ursinum, E. holosericeum, E. delicatum, and E. clavatum, the first two from California, the others from the extreme N. W. states. Fourteen of the species admitted are those of Haussknecht. It would be impossible here to enumerate the changes in nomenclature involved by this monograph, as there has been such a confusion of names that only the monograph itself can make them clear. The names as they appear in Watson's Bibliographical Index are not very materially changed, but the separation of unrecognized species by Haussknecht has added many new names to that list. The illustration of every species is a very valuable feature of the work; and this leads us to remark, that accurate figures should be more extensively used in such monographs; for however faulty the text may be, good figures are records of facts that cannot well change, and are only second in value to the plants themselves.

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[1] TRELEASE, WILLIAM.—The species of Epilobium occurring north of Mexico: 50 pp. 48 plates : 8 vo. [Reprinted from second annual report of the Mo. Bot. Garden : issued April 22, 1891.]

Baillon's "Histoire des Plantes."

The tenth volume of this great work, bearing the imprint of 1891, is at hand, and the American botanist always turns over its handsome pages with the greatest interest to discover the changes which affect his own plants. The present volume contains 476 pages, with 335 figures in the text, the families treated being Bignoniaceæ, Gesneriaceæ, Gentianaceæ, Apocynaceæ, Asclepiadaceæ, Convolvulaceæ, Polemoniaceæ, Boraginaceæ, and Acanthaceæ. In a somewhat hasty examination the following facts were noted with reference to North American plants:

GENTIANACEÆ.—*Frasera* Walt. is included under *Swertia* L.

APOCYNACEÆ.—Our single species of *Trachelospermum* is referred to *Forsteronia* G. F. W. Mey.; while the genus *Gelsemium* is included, having been transferred from Loganiaceæ.

ASCLEPIADACEÆ.—A wholesale merging of genera is made, by including *Gomphocarpus*, *Asclepiodora*, *Anantherix*, *Podostigma*, *Schizonotus*, and *Acerates* under *Asclepias*. *Vincetoxicum* Mœnch is placed under *Cynanchum* L.

CONVOLVULACEÆ.—*Calystegia* R. Br. is restored to generic rank, and *Bonamia* Dup.-Th. replaces *Breweria* R. Br.

POLEMONIACEÆ.—*Collomia* Nutt. is restored to generic rank, and all that was formerly *Gilia* becomes *Navarretia* Ruiz & Pav. Thus the name of one of our largest North American genera disappears, and a large harvest of species awaits the writer who first lists our species of *Navarretia*. How *Collomia* is kept distinct is not at all clear to the writer.

BORAGINACEÆ.—As is to be expected, the greatest changes are to be found in this much worked over group, and they are exceedingly hard to follow in any hasty review. However, the following facts seem clear: The whole family *Hydrophyllaceæ* appears under *Boraginaceæ*, and a well known ordinal name thus disappears. *Echinospermum* Swartz becomes *Lappula* Mœnch. *Eritrichium* Schrad. again appears with a part of its former species. *Cryptanthe* Lehm. also contains some former Eritrichiums. *Piptocalyx* Torr. stands for *Krynitzkia* Fisch. & Meyer. Professor Greene's genera *Eremocarya*, *Oreocarya*, *Allocarya*, and *Sonnea* are admitted, containing species variously referred heretofore to *Eritrichium* and *Krynitzkia*. *Plagiobothrys* Fisch. & Mey. is maintained, and includes *Echidiocarya* Gray. *Hydrophyllum* becomes *Hydrophyllon*. *Nemophila* Nutt. is merged under *Ellisia* L. *Draperia* Torr. goes to *Phacelia* Juss. With such an upheaval in our generic lines it will be a work of considerable difficulty to properly locate our species.

ACANTHACEÆ.—*Gatesia* Gray is reduced to *Dianthera* L.

Minor Notices.

The study of aquatic plants is rapidly increasing. Since Dr. H. Schenck published his two large papers upon the anatomy and biology of these forms, a French botanist, Mr. C. Sauvageau has given some very exact observations upon the anatomy of several aquatic monocotyledons. It may be of interest to botanists in this country to know these works, which certainly encourage further studies. They are all published in *Journal de Botanique* and the titles are as follows: Sur un cas de protoplasme intercellulaire (1889); Sur la racine du *Najas* (1889); Contributions à l'étude du système mécanique dans la racine des plantes aquatiques: Les *Potamogeton* (1889); *ditto*: *Zostera, Cymodocea* et *Posidonia* (1889); Observations sur la structure des feuilles des plantes aquatiques: *Zostera*, *Cymodocea* et *Posidonia* (1890); Sur la feuille des *Hydrocharidées* marines: *Enhalus*, *Thalassia* et *Halophila* (1890): Sur la structure de la feuille des genres *Halodule* et *Phyllospadix* (1890); Sur la tige des *Zostera* (1891).—T. H.

Professor F. Lamson-Scribner is the author of a small, but very readable and useful book on fungous diseases of the grape and other plants, just published by J. T. Lovett Co., of Little Silver, N. J. The diseases of the grape have recently been receiving very large attention, and from no one more than Professor Scribner. He, therefore, speaks first-hand and does not merely compile current information. Other diseases treated are those of the apple, pear, peach, plum, etc. The diseases are not only described in a simple and recognizable way, but the best known treatment is suggested. The book should be in the possession of every horticulturist.

The third biennial report of the California State Board of Forestry, for the years 1889–90, has just appeared. It is a voluminous pamphlet of over 200 pages, but is full of information concerning the forests of California. The well-known botanist, Mr. J. G. Lemmon, has collected a vast array of facts, and his descriptions are always graphic. An invaluable part of the report will be found in the 30 artotype plates, representing the general habit of characteristic trees and sometimes even their detailed structures. These photographic reproductions are always useful, for they represent a set of facts of permanent value, no matter how opinions concerning them may change.

Dr. Roland Thaxter has issued a paper on the Connecticut species of Gymnosporangium, as Bulletin 107 of the Connecticut Agricultural Experiment Station. A new species is characterized, viz. *G. nidus-avis*, the specific name referring to a "birds-nest" distortion it produces on Juniperus Virginiana. The Roestelia stage has been observed on quince and service-berry.

PROF. L. H. BAILEY has found time to write "The Nursery-book," a complete guide, not to the domestic matters which the first glance at its title will suggest, but to the multiplication and pollination of plants. The seven chapters have the following titles: Seedage, Separation; Layerage; Cuttage; Graftage; The Nursery List; Pollination. The book must be of great value to nurserymen, but it is also full of information and suggestion to the botanist, who has to teach, or who wants to experiment. It is published by the Rural Publishing Co. of N. Y. City.

MR. JOHN DONNELL SMITH has just issued the second part of his very handsome "Enumeratio Plantarum Guatemalensium." This part contains 100 pages of text, printed only on one side, and gives a full enumeration of all the Guatemalan plants collected by Mr. Smith and Baron von Türckheim since the appearance of the previous part. Certain groups have been distributed among specialists of this country and Europe, and the enumeration indicates a large number of new species.

FLORA FRANCISCANA, Part I, is the title of a new publication by our indefatigable friend, Professor E. L. Greene. As the author remarks on the title-page, this is "An attempt to classify and describe the vascular plants of middle California." Twenty orders are presented, beginning with Leguminosæ and ending with Caryophylleae, the obsolete distinction between Polypetalae and Apetalae being disregarded. One expects to find all sorts of departures from ordinary methods of classification, but the vast array of facts that have been collected by the direct field observation of a keen observer make this publication a very valuable one. Probably there always will be differences of opinion as to the drawing of ordinal, generic, and specific lines, but the facts, thus pigeon-holed according to the fancy of the observer, are permanent things. It would be impossible, in this notice, to call attention to the changes proposed, for this pamphlet of 128 pages contains in almost every page things interesting enough to be noted. However, Professor Greene's views are sufficiently well known to need no explanation. This part can be obtained for 75 cents, and it should be in the hands of every student of the Pacific slope flora.

THE CURRENT MEMOIR (vol. ii, no. 3) of the Torrey Botanical Club is by Mr. Theodore Holm, who presents a paper entitled "Contributions to the knowledge of the germination of some North American plants," handsomely illustrated by 15 plates. This paper deals with the description of the germination and early stage of growth and development of the rhizomes of certain plants. It must be said that

Mr. Holm is doing a very much needed piece of work, and such contributions to our knowledge of a very much neglected subject are exceedingly welcome. It is this kind of work which is laying up in store for the future systematist a set of facts that will make it more possible to present a natural classification.

FOUR ADDITIONAL PARTS (55 to 58) of *Die natürlichen Pflanzenfamilien* have lately appeared. No. 55 contains the beginning of the Cruciferae, by Prantl, in which the generic lines in vogue in America are maintained. No. 56 contains Cunoniaceae, by Engler; Pittosporaceae, by Pax; and Myrothamnaceae, Hamamelidaceae, Bruniaceae and Platanaceae, by Niedenzu. Nos. 57 and 58 contain the conclusion of Cruciferae, by Prantl; Moringaceae, Tovariaceae and Capparidaceae by Pax; Sarraceniaceae and Nepenthaceae by Wunschmann; Droseraceae by Drude; and Resedaceae by Hellwig.

A CATALOGUE of the "Flowering plants and higher cryptogams," both native and introduced, found within about 30 miles of Hanover, N. H., has just been published by Professor Henry G. Jesup, of Dartmouth College. An outline map is included, and about 60 pages of neat text present the names and habitats of the plants of a very interesting botanical region.

THE Trans. Kansas Acad. of Science, vol. xii (1889–90) is just at hand, and contains the following papers of botanical interest: Characteristic sand-hill flora (2 pp.), M. A. Carleton; Botanical notes for 1889 (2 pp.), J. H. Carruth; Methods of collecting, cleaning and mounting diatoms (2 pp.), Gertrude Crotty; Distribution and ravages of the hackberry branch knot (1 p. and 2 plates), Germination of Indian corn after immersion in hot water (2 pp. and 4 pp. of tables), Observations on the nutation of sunflowers, (3 pp. and 40 tables), W. A. Kellerman; Notes on sorghum smuts (2 pp. and 1 plate), Kellerman & Swingle; Evolution in leaves (4 pp. and 1 plate), Mrs. W. A. Kellerman; Radiation of heat from foliage (1 p.), A. G. Mayer; List of plants from Cherokee Co., Texas (2 pp.), Mrs. A. L. Slosson; Periodicity in plants (6 pp.), Additions to the flora of Kan. (14 pp.), B. B. Smyth; The union of Cuscuta glomerata with its host (1 p. and 1 figure), W. C. Stevens; First addition to the list of Kansas Peronosporaceae (5 pp.), W. T. Swingle; On the sugars of watermelons (1 p.), J. T. Willard.

OPEN LETTERS.

A plea for better botanical specimens.

An experience of five years in two of the large herbaria of this country, in which I have handled all the specimens as they came in from collectors all over the world, has confirmed my belief that too many botanists place a greater stress on quantity than quality. The distribution of C. G. Pringle's admirable specimens during the past few years, has produced among the fortunate few of his subscribers a change of opinion for the better; and the curators of herbaria, now crowded to overflowing with inferior specimens, are throwing more and more of the worthless material into the waste-basket. If exchanging botanists would give and demand none but good, complete specimens, the standard might be raised so that each addition to our numerous herbaria would be one of permanent value, not to occupy needed space until replaced by better specimens, some time in the far future.

A common fault is the breaking up of a single individual to make it go all around. Better one perfect and complete specimen in one herbarium, than many fragments in different places. Another common fault is the sending, as a complete specimen, a single individual of the smaller species. It betrays a small soul to ask that a single *Erigenia bulbosa* or *Viola blanda* shall count one in exchange. A fault in the opposite direction is the preparing of specimens too large for the herbarium sheet. I once mounted 200 species of grasses prepared by a professional collector, and every specimen that was more than sixteen inches tall, had to be moistened and pressed over.

Many extensive collectors even yet work as if picking flowers for a bouquet, in which the stem and radical leaves are not needed. The fruiting stage seems to pass unheeded by most collectors, unless they eat the fruit instead of sending it in, as there is a great dearth of fruit among the specimens and a corresponding demand for it by some of our systematic botanists.—L. H. DEWEY, *Washington, D. C.*

Pachystima Canbyi in cultivation.

I notice in the March number of the GAZETTE that mention is made of the cultivation of *Pachystima Canbyi* in Germany. I have grown it in my garden here since 1875. I gathered it in S. W. Virginia in company with Mr. Howard Shriver in that year, and as it grew comparatively well under cultivation I have kept it in my grounds since. It is called locally "rat-stripper," from the readiness with which the bark strips off the wood, leaving a long white tail, as it were. I have sent many plants of it to various parts of Europe. The closely allied species, *P. Myrsinites,* from Oregon has not as yet proved hardy with me.—GEO. C. WOOLSON, *Passaic, N. J.*

NOTES AND NEWS.

DR. GEO. L. GOODALE has returned from his tour around the world.

A NEW GENUS of orchids, from Australia, Adelopetalum by name, is described by R. D. Fitzgerald in *Jour. Bot.* (May).

DR. LUCIEN M. UNDERWOOD has resigned his chair at Syracuse University to accept the professorship of botany at De Pauw University.

DECADES IX and X of Underwood and Cook's Hepaticae Americanae have been issued, and two more are almost ready for distribution.

DR. A. N. BERLESE has been called to the position of professor of botany and plant-pathology at the Royal School of Viticulture, at Avellino.

DR. W. A. SETCHELL, assistant in biology at Harvard University has been appointed to a similar position at Yale University. The department is under the charge of Prof. S. J. Smith.

IN THE *Journal of Botany* (May), the editor protests vigorously against Professor Henslow's theory of environment as an origin of species, as being a theory unsupported by facts.

DR. W. C. STURGIS, who has been assistant in cryptogamic botany at Harvard University has been appointed botanist to the Connecticut Agricultural Experiment *vice* Dr. Thaxter, resigned.

DR. B. L. ROBINSON, assistànt in the Gray Herbarium for the past year, has been compelled to resign the position on account of ill health resulting from poisoning due to the arsenic used in preserving the specimens.

IN THE report of the Division of Forestry of the Department of Agriculture for 1890, it is shown that forestry is taught in the Agricultural Colleges of 17 states, and in 8 of them it is only incidentally touched upon.

VASEYANTHUS is a new genus of cucurbits from Lower California, described in *Zoe* (Feb.) by A. Cogniaux. Associated with Dr. George Vasey in the name is that of his assistant Mr. Rose, the plant appearing as V. Rosei.

A CATALOGUE of Nebraska phanerogams has been published by Professor Swezey, of Doane College, Crete, Nebr. The list, numbering 533 species and varieties, contains only those plants represented in the college herbarium.

DR. ROLAND THAXTER, of the Connecticut Agricultural Experiment station, has been elected assistant professor of the cryptogamic botany at Harvard University. In the probable absence of Dr. Farlow next year he will have charge of his work.

DR. AND MRS. BRITTON sailed for England June 6. Dr. B. takes a portion of Dr. Morong's S. American plants to Kew for determination and Mrs. B. expects to visit several of the bryological herbaria for study and comparison of American mosses.

In the third annual report of the Agricultural Experiment Station of West Virginia, the botanist, Dr. C. F. Millspaugh, speaks of a great variety of subjects, chiefly by way of instructing his constituency as to the noxious and useful plants of their flora.

Dr. Lucien M. Underwood spent several months of the past winter in collecting in Florida and Cuba for the Department of Agriculture. He brought back not only a considerable collection of Phanerogams, but also a large number of Hepaticae and Mosses.

Dr. E. Koehne, of Friedenau, well known as the editor of Just's *Jahresberichte*, and for his work upon the Lythraceae and other orders, has been invested with the title "Professor"—a title of more difficult acquisition, and hence more honorable, in Germany than in this country.

The poisoning of plants having proved ineffectual has been entirely abandoned at the Gray Herbarium. The tightness of cases and the handling of the sheets are relied upon to preserve the specimens. Any which become infested may be treated to a stay in CS_2 vapor, or some other insecticide.

In the *Bulletin of the Torrey Botanical Club* (May), Messrs. Anderson and Kelsey describe some new algae from Montana; Mr. Murray describes a new Myriophyllum from Michigan and calls it M. Farwellii from its discoverer; and Dr. Porter characterizes a new Liatris from North Carolina, to be known as L. Helleri. The Liatris is from the top of Blowing Rock Mt., Watauga Co.

In his notes on the histology of Polysiphonia fastigiata (*Jour. Bot.* May), Professor R. J. H. Gibson concludes that protoplasmic continuity is maintained only in young cells, and that the delicate strands which appear on both sides of the "plug" in older cells represent simply a delicate fringe arising from the margin of the plug itself and quite independent of the protoplasmic contents of the canal.

Professor Conway MacMillan, in *Amer. Nat.* (Feb.), gives an interesting table showing the comparative distribution southward of certain distinctly boreal genera of phanerogams by the Rocky and Appalachian mountain systems. The conclusion drawn is that the loftier mountain ranges have caused the extension southward of a correspondingly larger number of species. The table, as prepared, shows that twice as many species of northern genera have come southward along the twice as lofty Rocky Mountains as along the Appalachians.

M. Pierre Viala describes in the *Revue générale de Botanique* for April a disease of the vine which has caused considerable loss to the nurserymen in the central and southwestern parts of France during the past three years. The malady attacks the grafts and prevents the union of the stock and scion, which are usually kept for some time in sand in order to retard the growth of the buds until the proper season. Sclerotinia Fuckeliana is the cause of the trouble, and it seems to be transmitted from year to year in the sand. A thorough drying of this in the sun before using seems fatal to the spores and a preventive of the disease.

A PRIVATE LETTER from Lt. R. E. Peary, of the U. S. Navy, who proposes to attempt to reach the north pole on foot through Greenland, contains the following information that will be of interest to botanists: "I leave this country next June for Whale Sound, Greenland, from which point as a base I propose to determine the northern terminus of Greenland over the inland ice. I expect to be absent from 1½ to 2½ years. The region about Whale Sound is rich in Arctic plants, Kane having brought home 106 species of Phanerogams, and 42 species of Cryptogams, several of which were new. I am under the impression that with the exception of the above collection, and Hayes' from the same region, there are few plants from the Greenland higher latitude in this country, and that fresh specimens, subjected to modern methods of scientific research, would yield valuable results. Some specimens which I brought home from Greenland in 1886, have been considered valuable." Since the above was written, arrangements have been made with Lt. Peary to turn over his collections to the Philadelphia Academy of Sciences.

It is a well-known fact, that abnormally developed leaves are far from rare in nature, but one of the most peculiar forms is undoubtedly that to which Russell has called attention.[1] It is the so-called ascidia-form which has been observed in several families, although as a mere abnormity. The appearance of such leaves varies from cornet-like, where the two margins of the blade of a leaf have grown together at the base, to hood-like, where the margins are entirely united for their whole length. This last form has been observed by Russell, in the leaflets of the uppermost leaves of Vicia sepium, intermixed with cornet-shaped and normal ones. In these abnormal leaflets, the cells of the mesophyll have increased enormously in size, forming a nearly solid tissue. The shape of the cells of the two lowest strata of the mesophyll, especially those just under the inferior epidermis and close to the midrib, has also been transformed. They have become much higher than broad, very much like the palisade-tissue of the superior face. The fibro-vascular bundles have been moved towards the superior face of the blade, but have not been modified essentially. Chlorophyll was rather scarce in these abnormal leaflets. This transformation is due to puncture of an insect made in the superior epidermis. Larvae were found in the younger ascidia, probably belonging to a Cecidomyia.—T. H.

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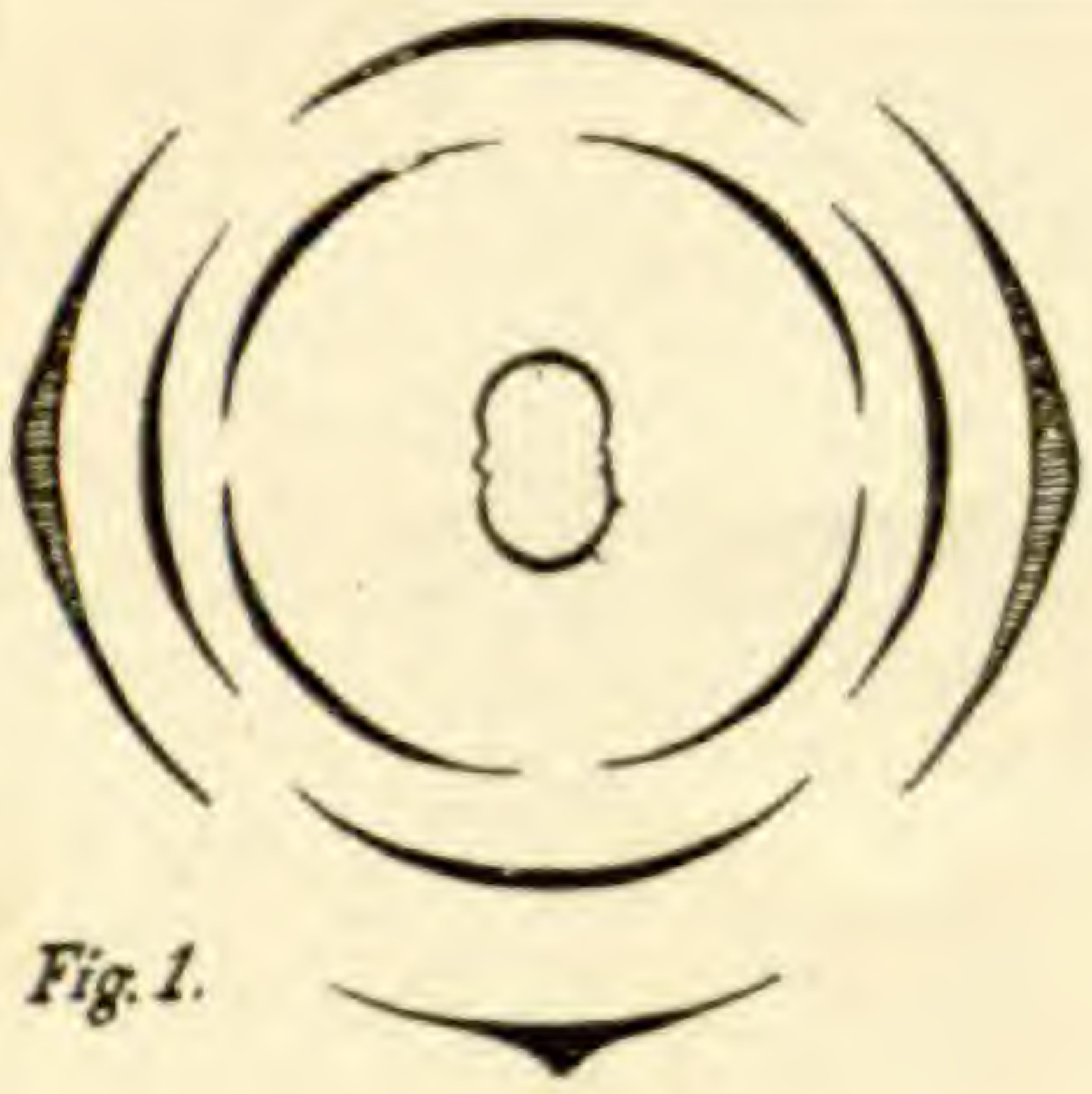
[1] Étude des folioles anormales du *Vicia sepium:* Revue générale de Botanique, no. 23.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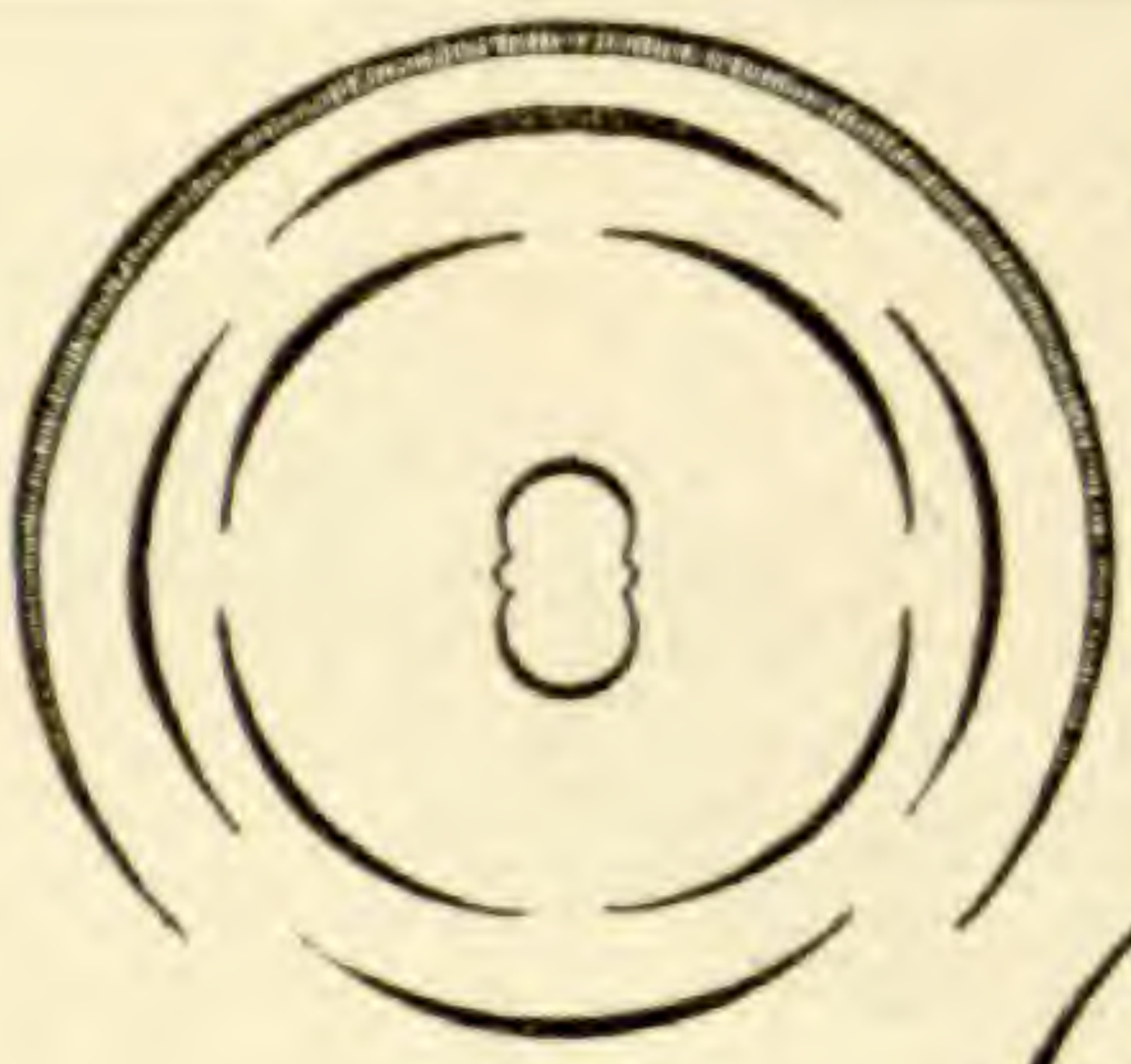
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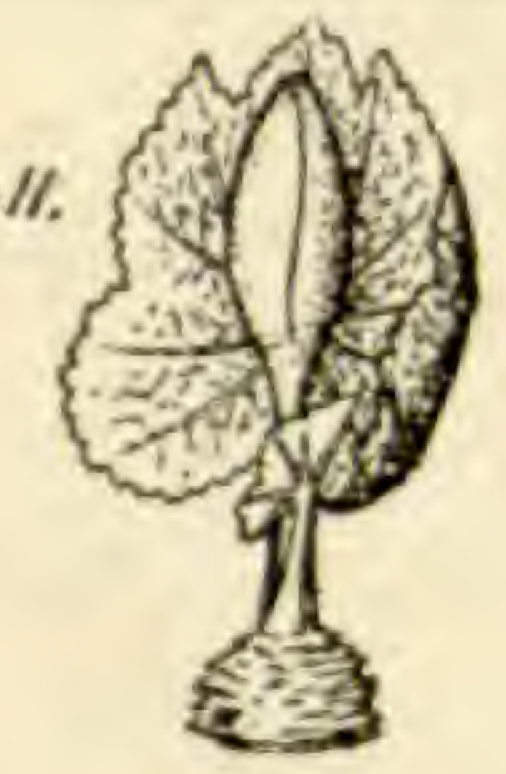
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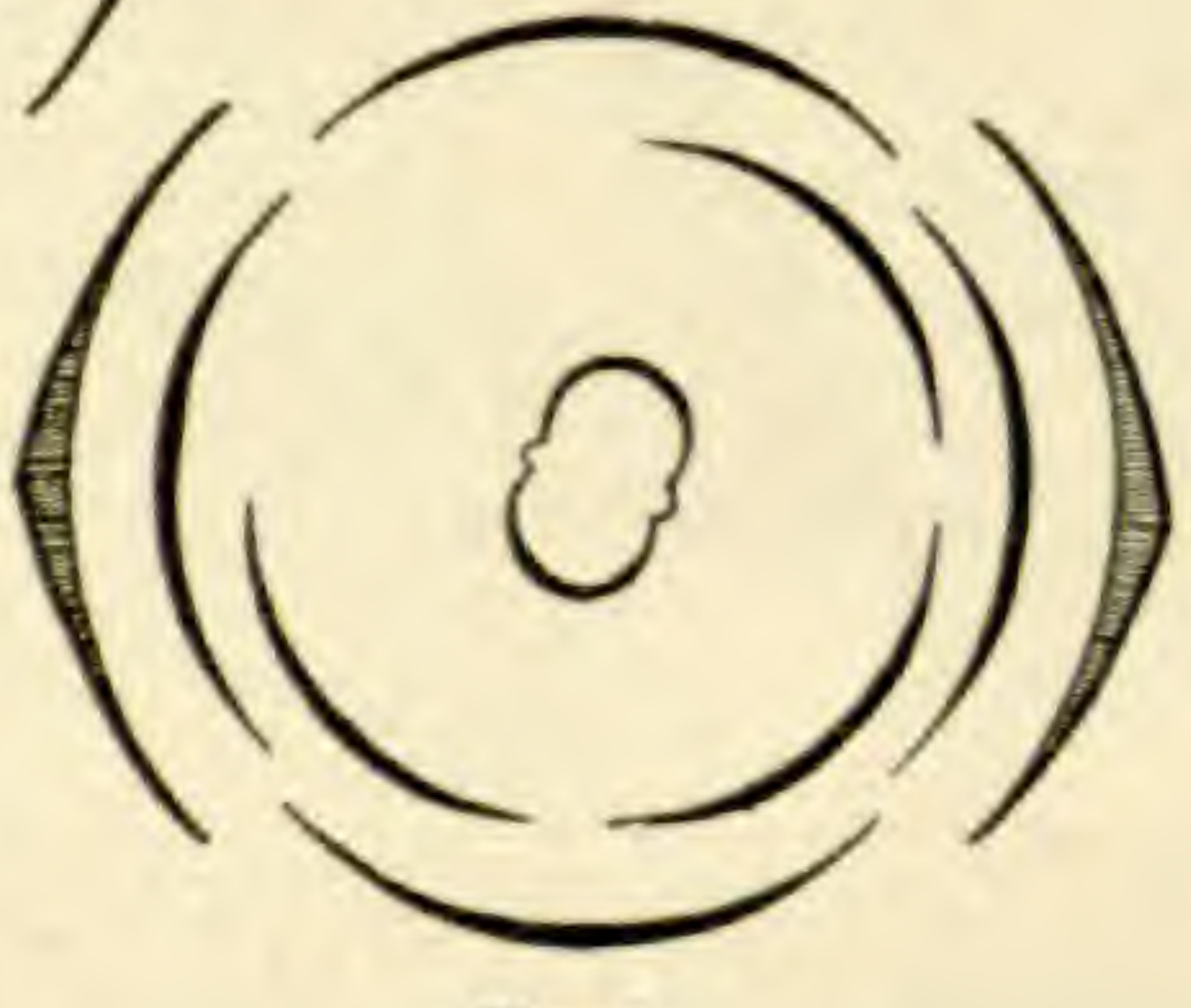
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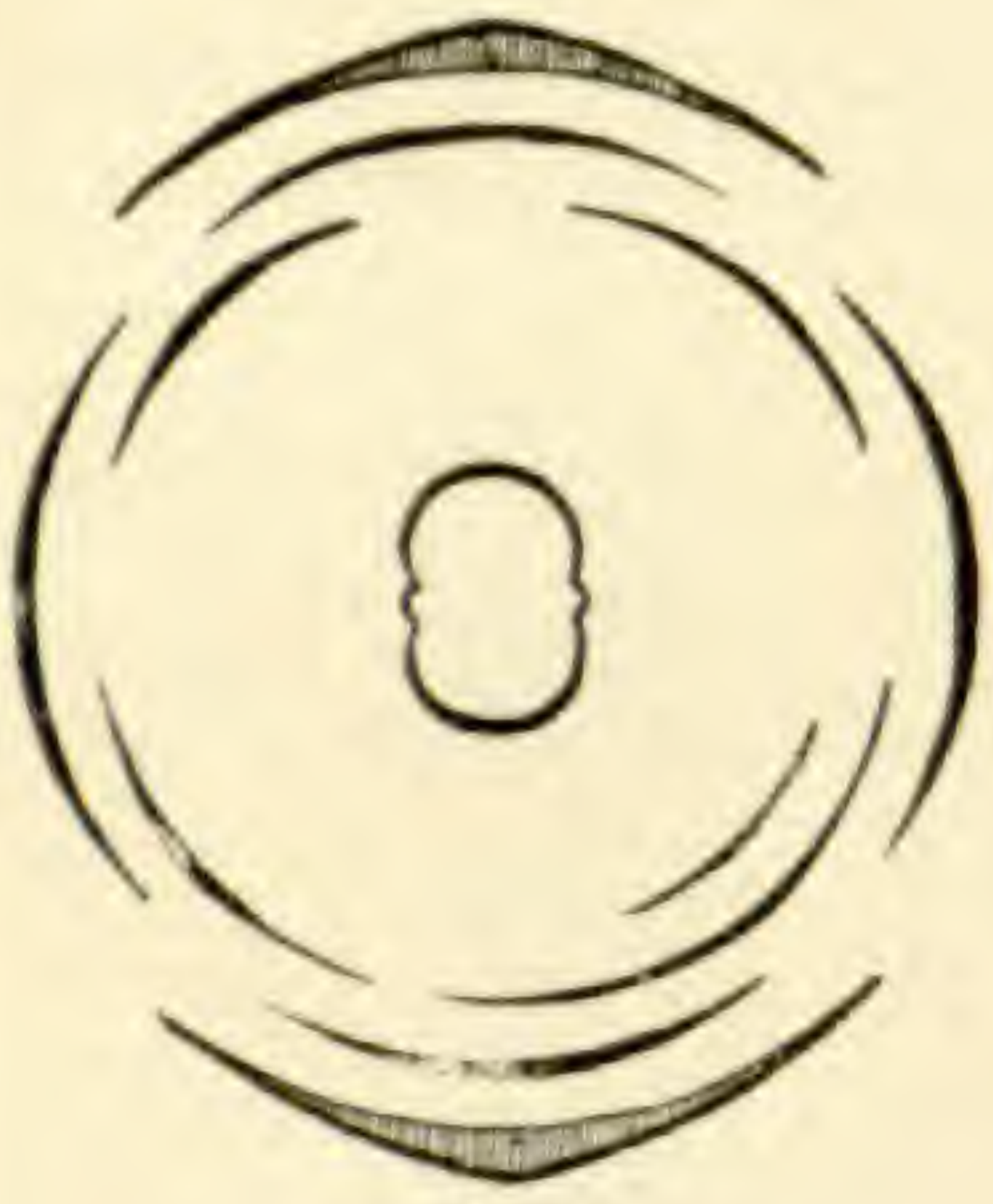
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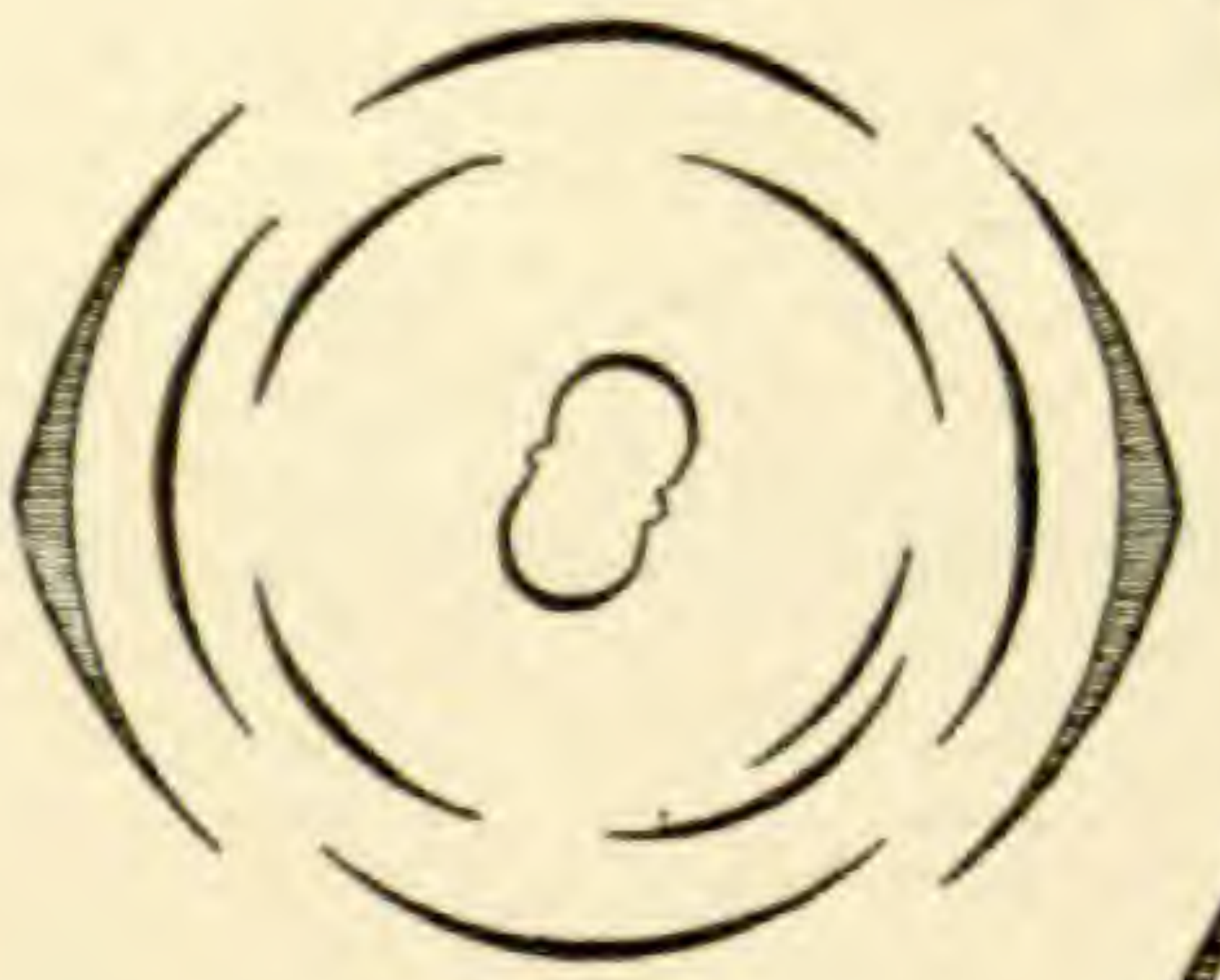
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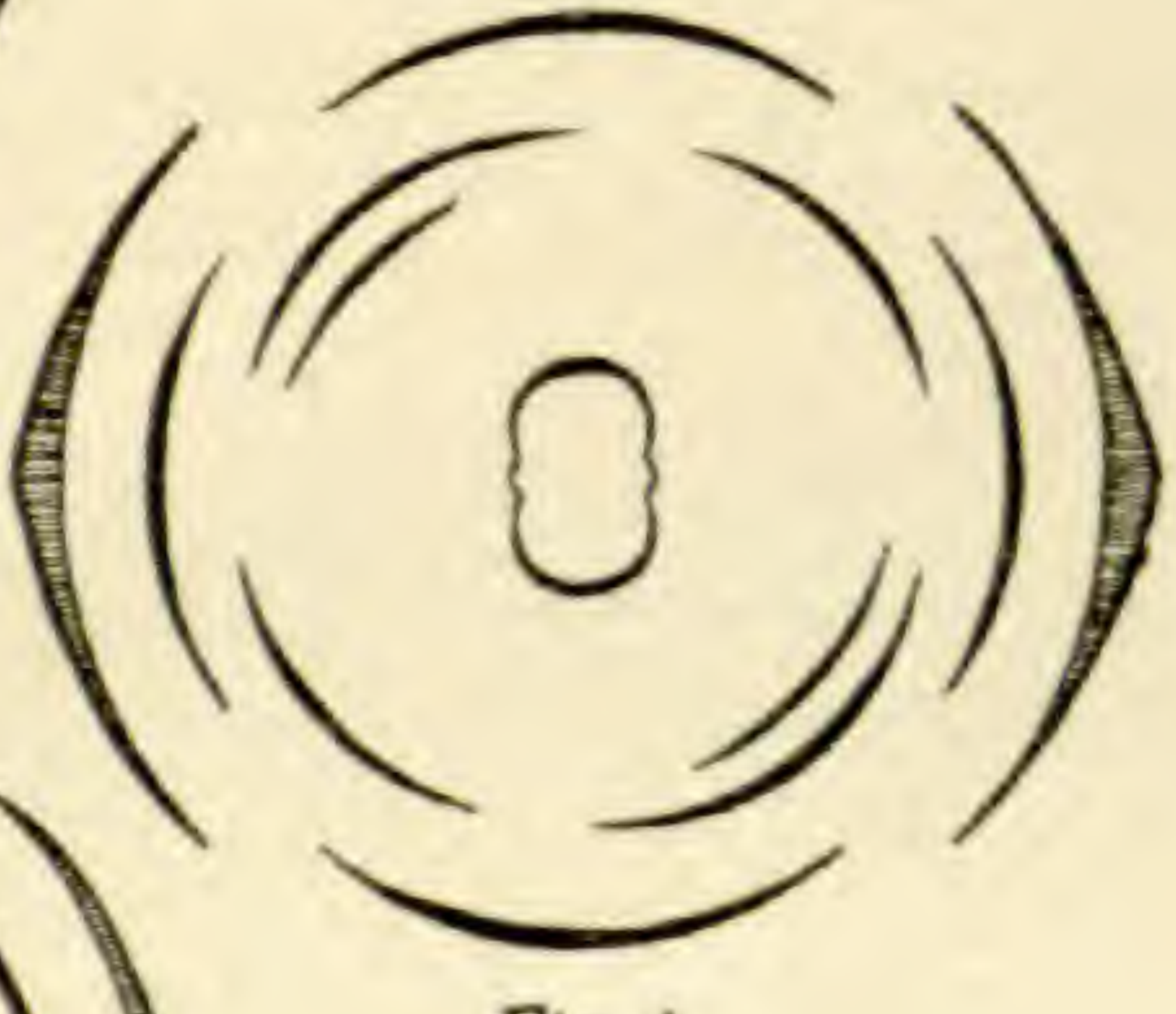
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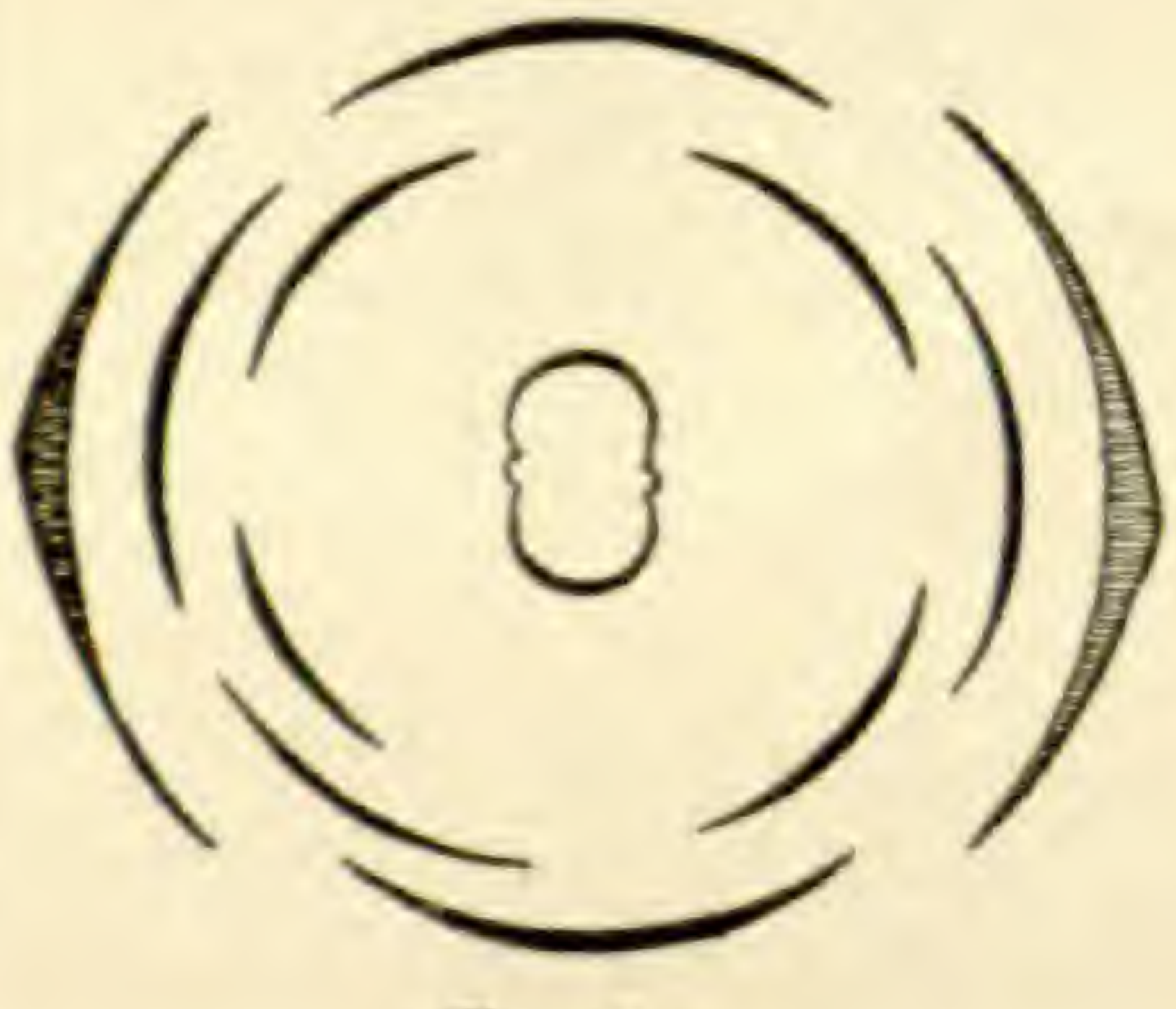
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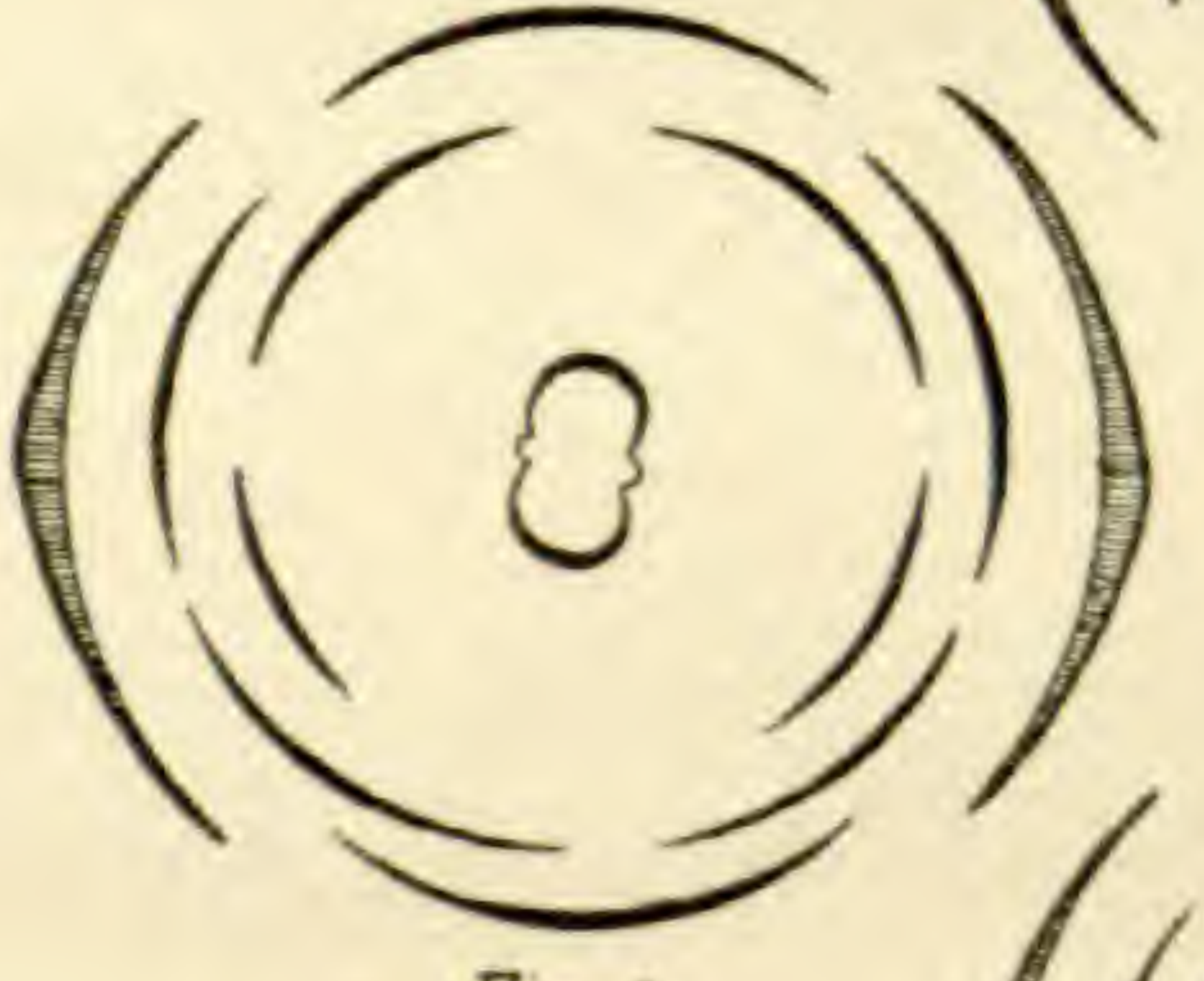
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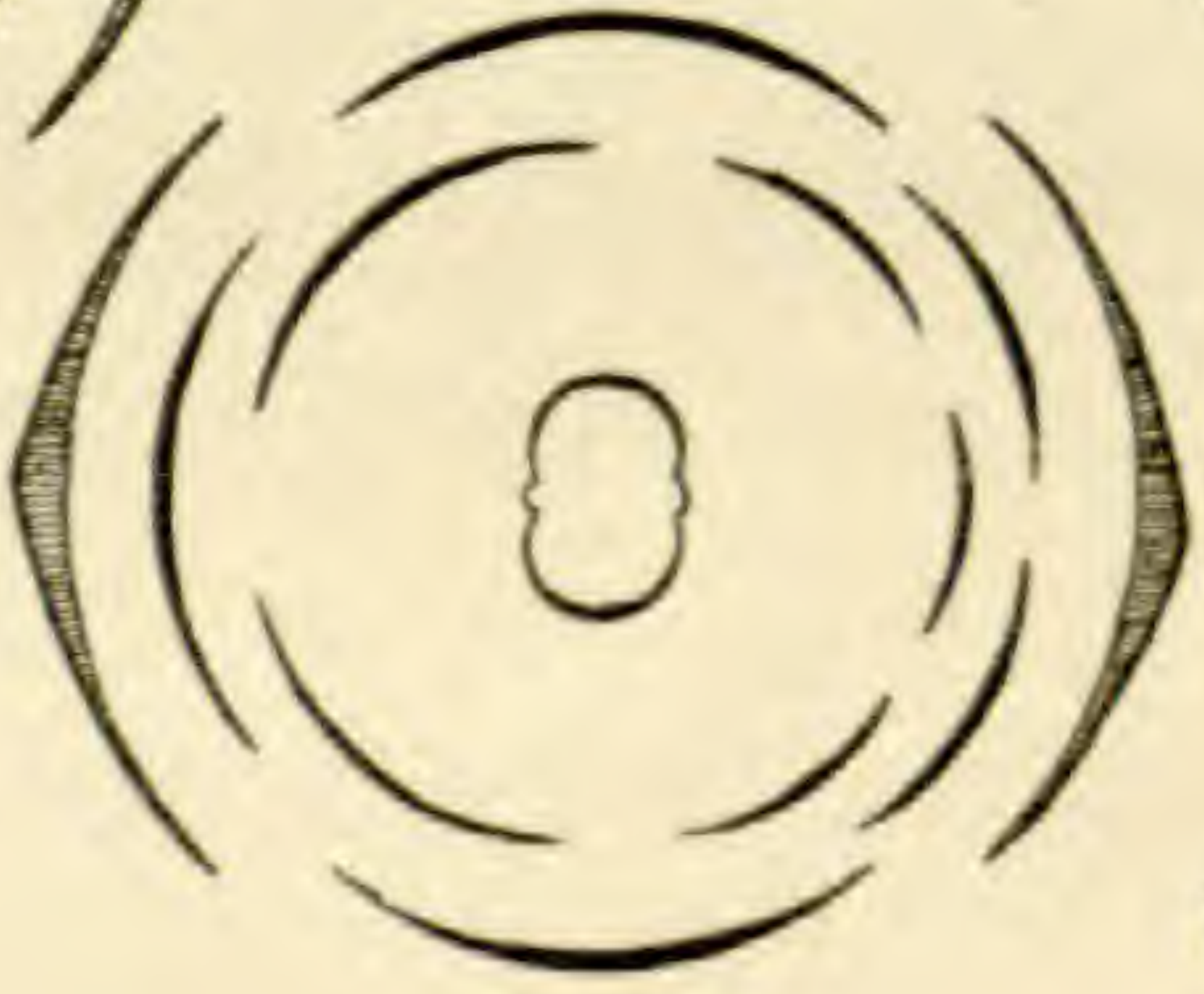
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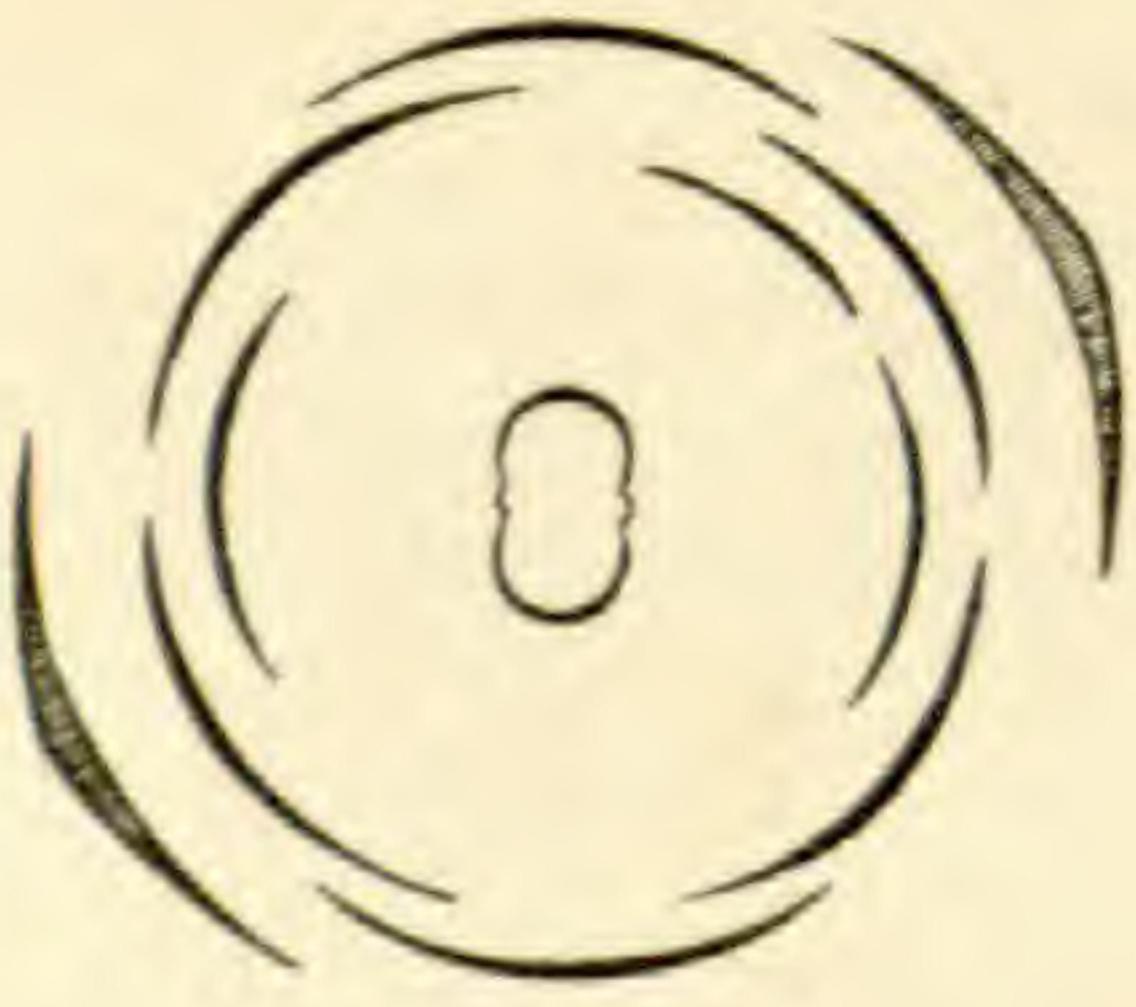
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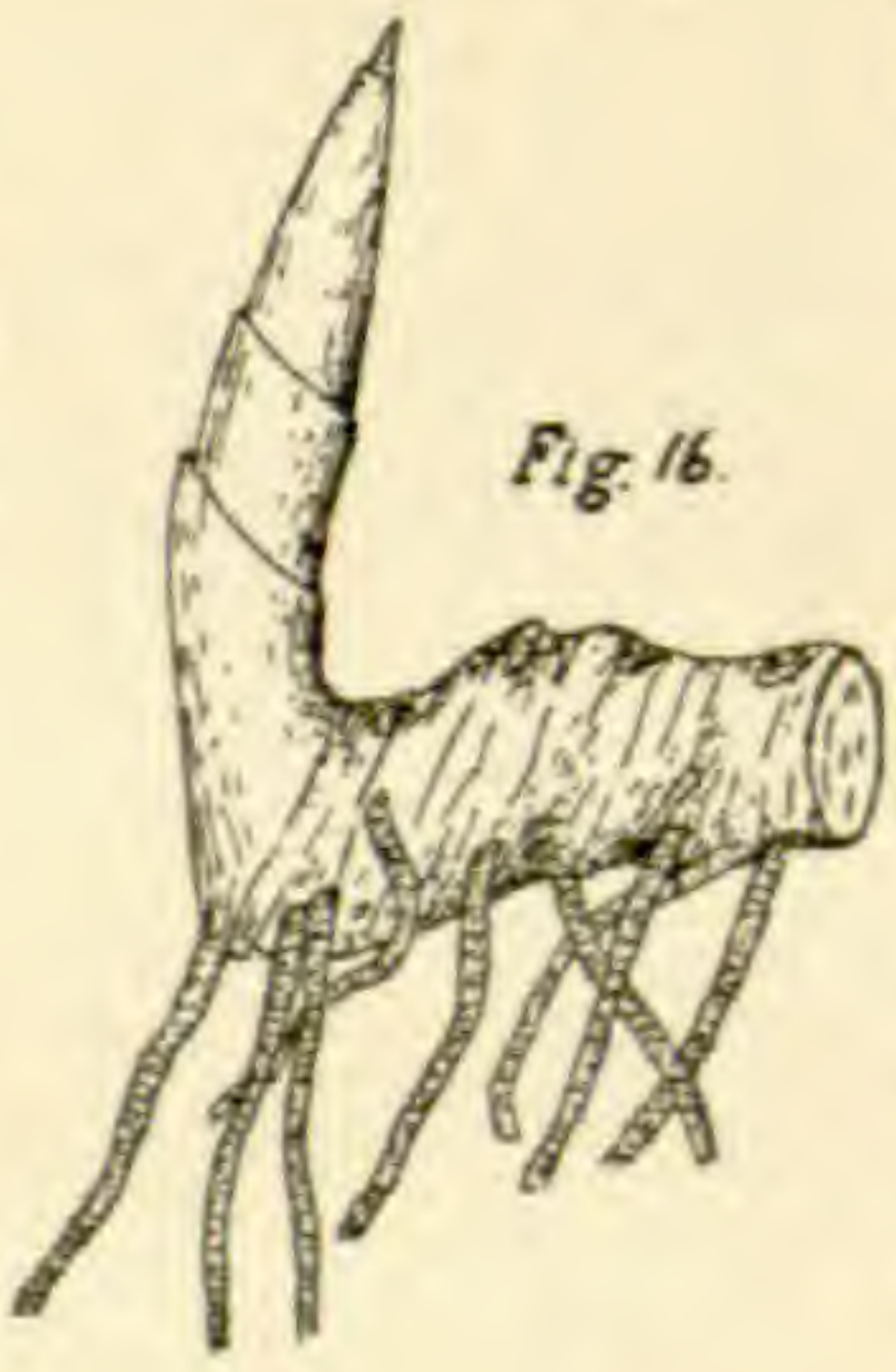
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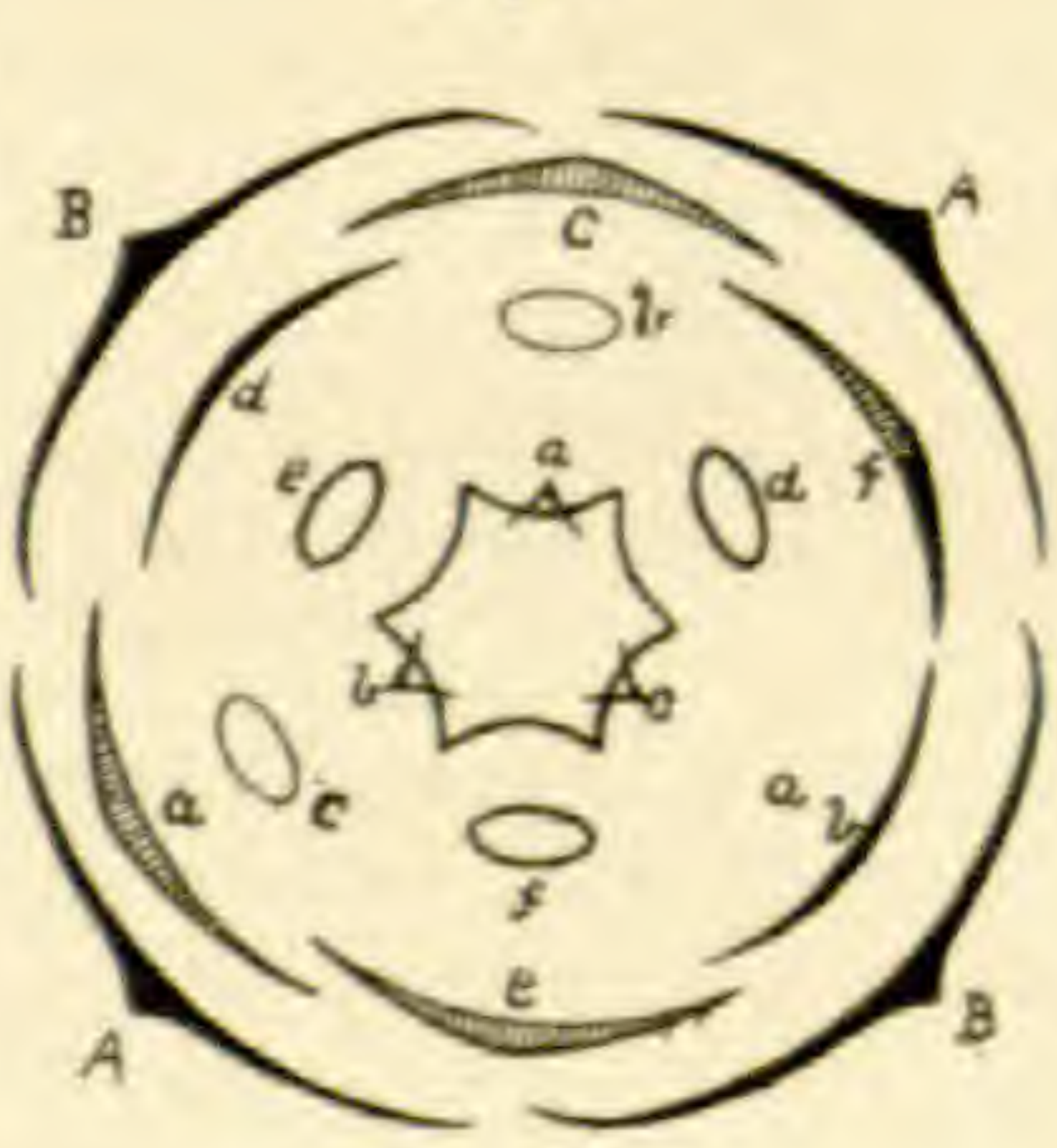
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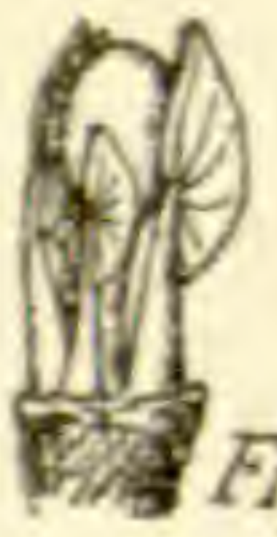
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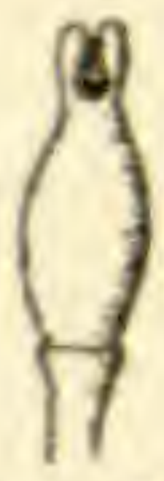
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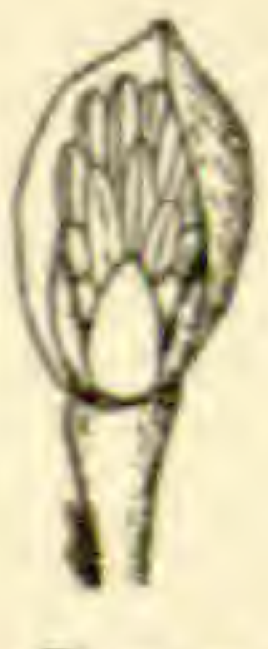
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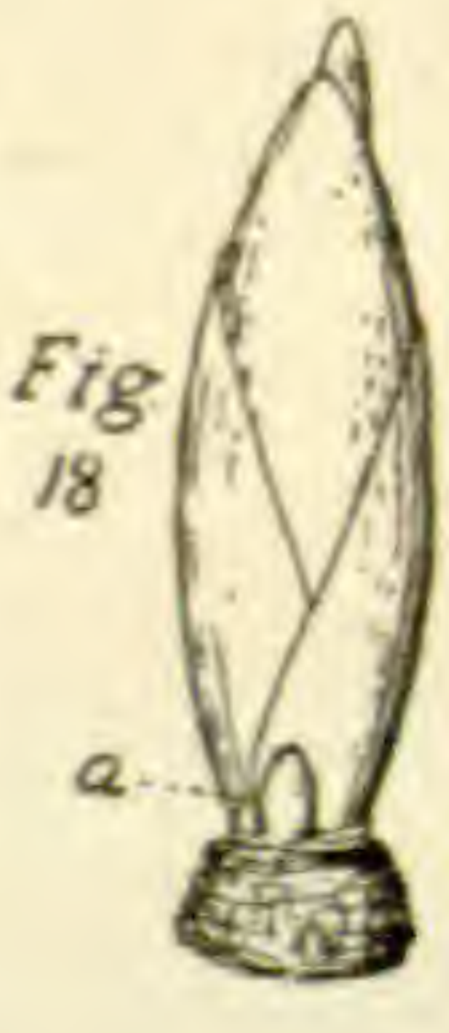

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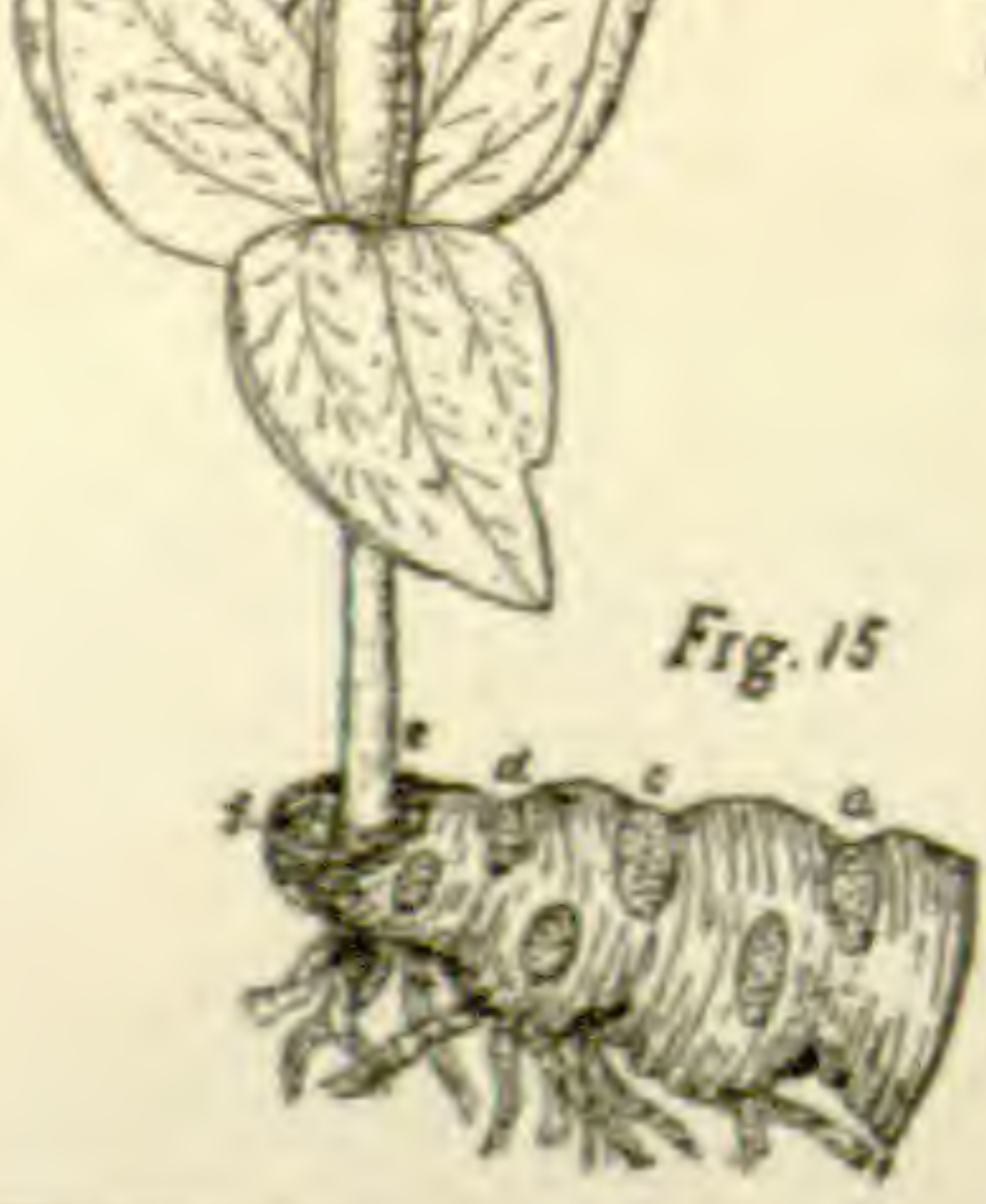

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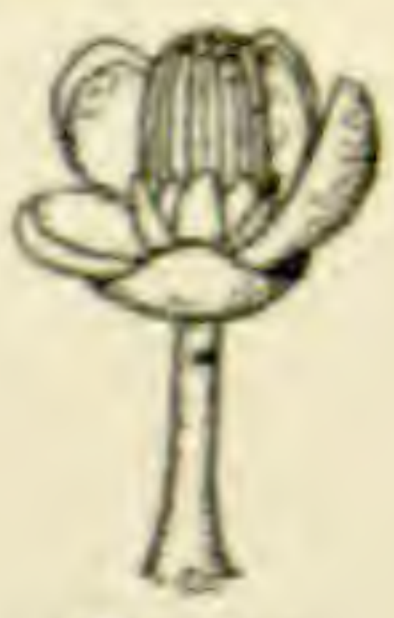
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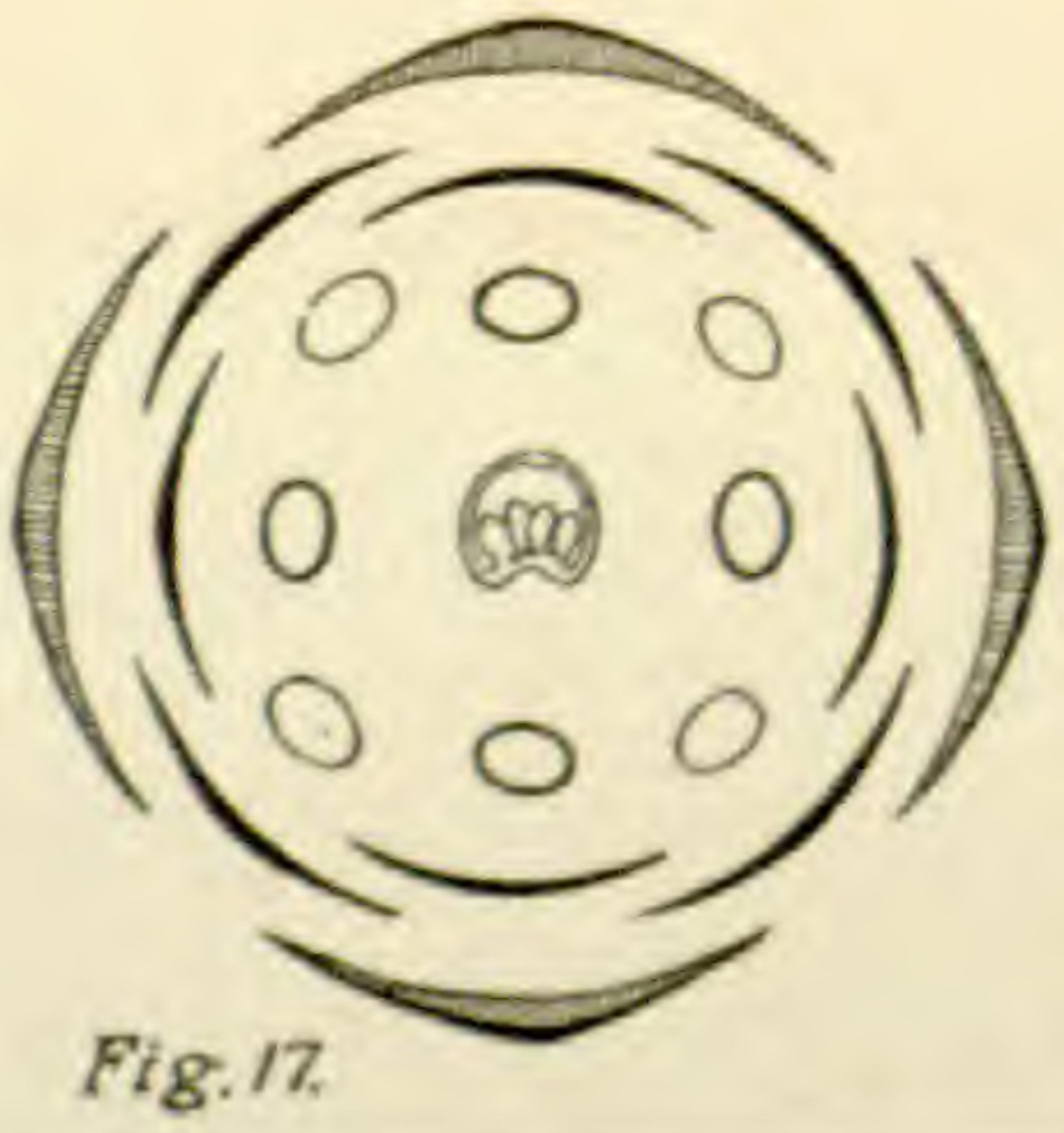
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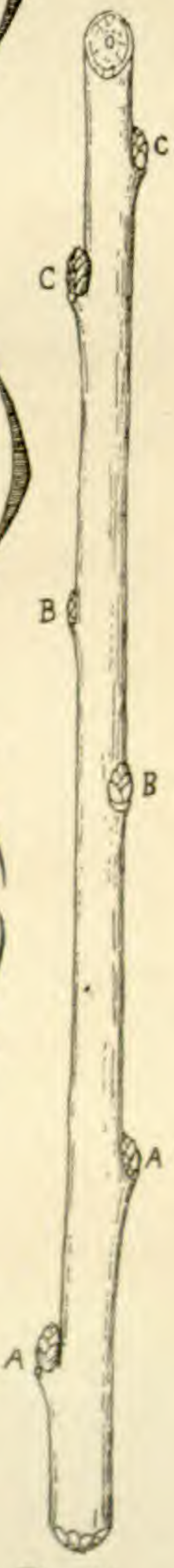

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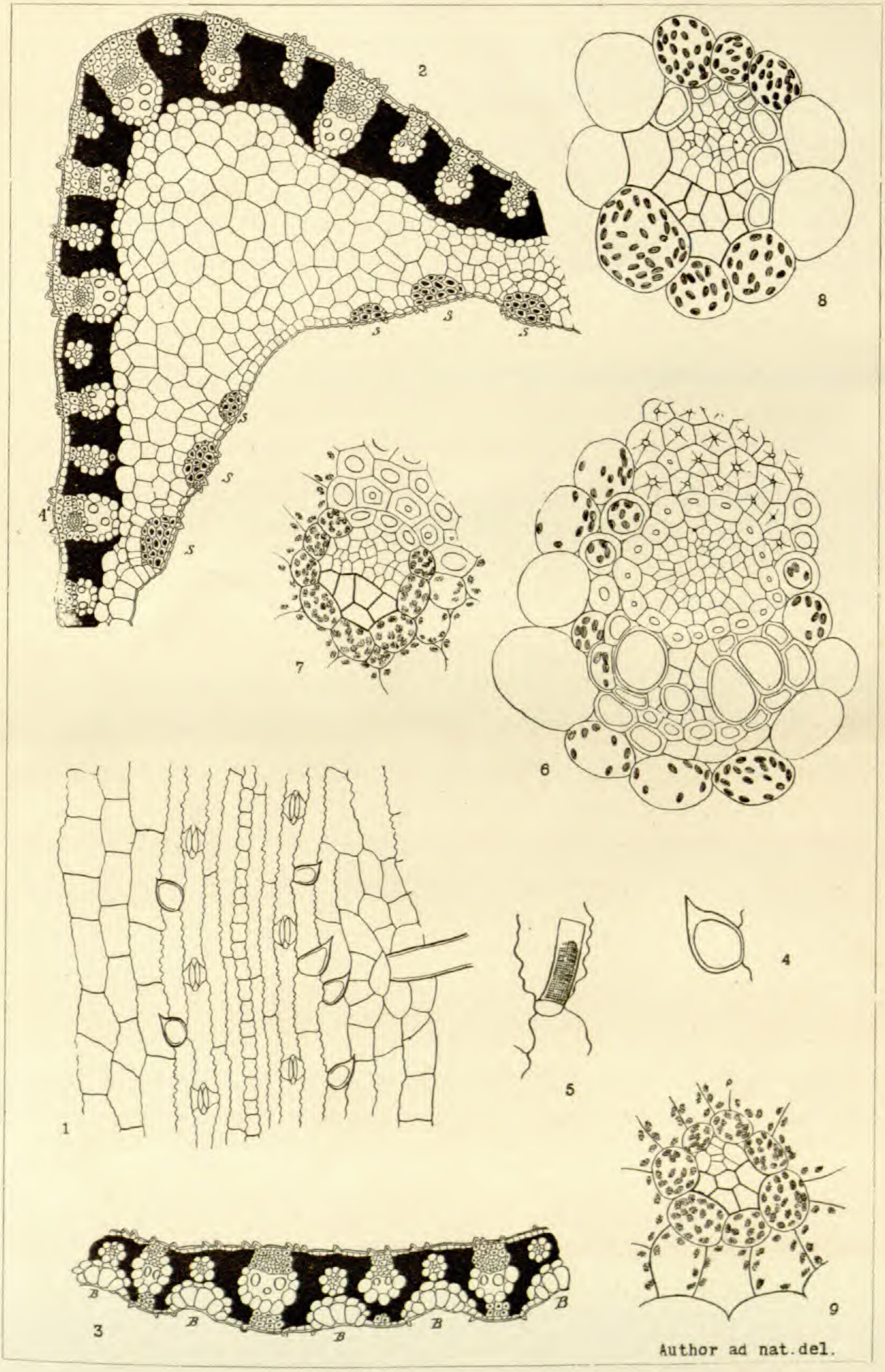
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HOLM on UNIOLA.

SOUTHERN PLANTS.

I shall have no class in Cryptogamic Botany in Cambridge this summer, but shall spend July to September collecting all kinds of botanical specimens in the Southern Alleghanies and on the Gulf Coast, giving special attention to *economic plants*, as *grasses* and *fungi*. I shall be pleased to correspond with persons wishing special collections made.

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VOL. XVI. JULY, 1891. NO. 7.

THE BOTANICAL GAZETTE

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[ISSUED JULY 20.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

Address C. R. BARNES at Cambridge, Mass., until Sept. 1.

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VOL. XVI. NO. 6.—BOTANICAL GAZETTE.—JULY, 1891.

Undescribed plants from Guatemala. IX.

JOHN DONNELL SMITH.

(WITH PLATES XVI, XVII, XVIII.)

New species, described by Prof. L. Radlkofer and by Dr. M. T. Masters, are included among those of this paper.

Serjania rufisepala Radlk.—Scandens, fruticosa, glabra; rami canaliculato-6-sulcati, cortice subfusco; corpus lignosum simplex, sulcatum (fasciculis vasorum angulis subjectis corporum lignosorum periphericorum speciem interdum præbentibus ut in Serjania sordida affinibusque); folia biternata; foliola sat magna, elliptica, superiora acuminato-cuspidata, terminalia in petiolulum attenuata, lateralia sessilia, omnia integerrima, subcoriacea, penninervia, nervis lateralibus utrinque 5–6 validioribus arcuato-adscendentibus supra subtusque prominulis, utrinque glaberrima, nec nisi glandulis microscopicis adspersa, supra nitida, fuscescenti-viridia, punctis pellucidis subfuscis notata, epidermide mucigera; petioli omnes nudi; thyrsi in ramis lateralibus paniculatim congesti; cincinni sessiles; flores minores; sepala omnia rufescenti-tomentella; fructus (—immaturi tantum suppetebant) pulchre sanguinei, breviter ovati, loculis canescenti-puberulis, alis glabris.

Rami thyrsigeri diametro 4–5 mm. *Folia* circ. 20 cm longa, 14 cm lata; foliola terminalia petiolulo 8 mm longo adjecto 11 cm longa, 5 cm lata, lateralia decrescentim minora; petiolus communis 3.5 cm longus; stipulæ minutæ. *Thyrsi* circ. 7 cm longi, rhachi puberula; cincinni abbreviati; pedicelli breves, fructigeri 3 mm longi. *Flores (masculi)*: sepala interiora 2.5 mm longa. *Petala* sepalis vix longiora, intus glanduligera; squamæ superiores crista bifida appendiceque deflexa brevi dense villoso-barbata, inferiores crista oblique dentiformi instructæ. *Tori* glandulæ ovatæ, basi puberulæ. *Staminum* filamenta villosiuscula, antheræ glabræ. *Germinis* rudimentum parvum, trigonum, puberulum. *Fructus* (immaturus) 2–2.2 cm longus, 1.8 cm latus.—*Obs.* Affinis *Serj. sordidæ* Radlk. (Sect. xi; cf. Radlk. Serjaniæ Monogr. p. 272; Suppl. p. 141).

Tres Cruces, Dept. Alta Verapaz, alt. 4,800 ft., Apr. 1889, J. D. S., (Ex Pl. Guat., qu. edid. J. D. S., 1766).

Serjania psilophylla Radlk. (*Serjania spec.*, John Donnell Smith Enumeratio Plantarum Guatemalensium, Pars I, 1889, n. 1153.)—Scandens, fruticosa, glabra; rami 6-sulcati, cortice e viridi pallide subfusco, ad costas rubescente; corpus lignosum simplex, hexagonum, leviter sulcatum; folia biternata; foliola ex oblongo vel ovato lanceolata, præsertim terminalia

in acumen acutum sensim attenuata eademque in petiolulum conspicuum attenuata, lateralia in petiolulos breves contracta vel subsessilia, omnia integerrima, penninervia, nervis lateralibus utrinque 7–9 curvato-adscendentibus supra subtusque prominulis, infimis eorum reliquis vix longioribus, utrinque glaberrima, nec nisi glandulis microscopicis adspersa, nitidula, submembranacea, e viridi pallide fuscescentia, punctis lineolisque pellucidis subfuscis notata, epidermide mucigera; petioli omnes nudi; thyrsi in ramulis lateralibus paniculatim congesti, glabri; cincinni subsessiles; flores mediocres; sepala pulverulento-puberula; fructus . . . .

Rami thyrsigeri diametro 3 mm. *Folia* 18–20 cm longa; foliola terminalia petiolulo 6 mm longo adjecto 10.5 cm longa, 3 cm lata, lateralia decrescentim minora; petiolus communis 4 cm longus; stipulæ minutæ. *Cincinni* contracti, circ. 6-flori; pedicelli 2–2.5 mm longi, supra basin articulati; alabastra obovoidea, 2 mm longa. *Flores hermaphroditi: sepala* interiora 3 mm longa. *Petala* ex oblongo attenuata, 3.5 mm longa, intus laxe glanduligera; squamæ (cristis exclusis) petala dimidia æquantes, margine villosiusculæ, superiores crista usque ad basin bifida (laciniis subacutis erectis) appendiceque deflexa brevi obtusa dense villoso-barbata, inferiores crista corniformi erecta instructæ. *Tori* glandulæ ovatae. *Stamina*: filamenta villosiuscula; antheræ glabræ. *Germen* pyriforme, trigonum, minutim canescenti-puberulum; stylus brevis; stigmata stylum æquantia.—*Obs.* Affinis *Serj. acutæ* Tr. et Planch. (Sect. xi; cf. Radlk. Serjaniæ Monogr. p. 274. Suppl. p. 142).

Rocks at Coban, Dept. Alta Verapaz, alt. 4,300 ft., March, 1887, v. Türckheim, (Ex Pl. cit. 1153).

Serjania rachiptera Radlk.—Scandens, fruticosa, glabriuscula; rami 6-costati, striato-sulcati, glabri, juniores tantum crispato-puberuli, cortice viridi ad costas pallide subfusco; corpus lignosum simplex, sulcatum, medulla ampliore repletum; folia ambitu triangularia, bipinnata vel pinnarum infimarum pinnulis infimis in foliolorum triades dissociatis transeuntia insupra decomposita, 6–8-juga, pinnis inferioribus 4-jugis, superioribus decrescentibus, summis foliola simplicia exhibentibus; foliola (pinnulæ) parva lateralia elliptica vel suborbicularia, terminalia subrhombea cum lateralibus proximis interdum confluentia, omnia sessilia, paucidentata, subchartacea, utrinque glabra nec nisi glandulis microscopicis adspersa, viridia, subtus pallidiora, punctis lineolisque pellucidis obsoletius notata, epidermide mucigera; petiolus communis perbrevis, nudus, margine hirtellus, rhachium omnium segmenta omnia alata, supra ad lineam medianum puberula; thyrsi solitarii vel in ramulis lateralibus paniculatim congesti, graciles; cincinni stipitati, abbreviati, puberuli; flores mediocres, albidi; sepala exteriora laxius, interiora basi densius puberula; fructus . . .

Rami thyrsigeri diametro 2 mm. *Folia* inferiora 14 cm longa, 9 cm lata; foliola terminalia 2.5 cm longa, 1.2 cm lata, lateralia inferiora (suborbicularia) diametro circ. 1 cm, superiora (elliptica) minora, angustioria; petiolus communis 0.5 cm, vix excedens, rhacheos primariæ segmenta inferiora 2 cm longa, 4 mm lata, superiora decrescentim breviora pinnarum vix 1 cm longa; stipulæ parvæ, ovato-triangulares. *Thyrsi* folia superantes, inferiores 16–18 cm longi, rhachi pedunculum communem glabrum gracilem apice haud raro circinatum subæquante puberula dense cincinnifera; cincinni stipite 4–5 mm longo suffulti, 7-9-flori, puberuli; pedicelli 2.5 longi, prope basin articulati; alabastra obovoidea, pedicellos æquantia. *Flores masculi: sepala* interiora 3.5 mm longa. *Petala* spathulata, sepala vix superantia, intus laxe glanduligera; squamæ superiores crista emarginato-bifida (laciniis acutis patulis) appendiceque deflexa brevi barbata, inferiores crista sat alta oblique emarginata instructæ. *Tori* glabri glandulæ superiores semiorbiculares, inferiores minores. *Staminum* filamenta pilosiuscula; antheræ glabræ. *Germinis* rudimentum trigonum, glanduligerum, ceterum glabrum.— *Obs.* Affinis *Serj. Cambessedeanæ* Schlecht. et Cham. Sect. xii; cf. Radlk. Serjaniæ (Monogr. p. 290; Suppl., p. 150.)

Guarda Viejo, Dept. Guatemala, alt. 5,000 ft., Febr., 1890 J. D. S., (Ex Pl. cit. 1907).

Paullinia scarlatina Radlk.— Scandens, fructicosa; rami juniores pentagoni puberuli, adultiores subteretes, striati, lenticellorum seriebus notati; corpus lignosum simplex; folia 5-foliolato-pinnata; foliola superiora ex elliptico sublanceolata, inferiora ovata, apice in acumen obtusum producta, basi superiora longius breviusve attenuata, inferiora rotundata, omnia breviter petiolulata, integerrima, vel dente uno alterove notata, chartacea, transversim venosa, praeter axillas nervorum subtus barbatas glabra, nitidula, glandulis, microscopicis curvatis obsita, utriculis laticiferis reticulatis pellucidis sat crebris supra subtusque instructa, epidermide mucigera; petiolus basi utrinque vasorum fasciculo corticali instructus; rhachis submarginata; stipulatae parvæ, triangulares; thyrsi solitarii, axillares; bracteæ bracteolæque parvæ, subulatæ; flores sat magni, sepalis 3–5 fere omnino liberis; fructus ellipsoideus stipitatus, subapiculatus, valvarum costa mediana evanina tricostatus, extus glabriusculus, intus pilis longis fuscidulis dense villosus; semen late ovoideum, ventre subcarinatum, glabrum, arillo dorso fisso usque ad medium obtectum; cotyledones oleigeræ, interior tenuior, transversim plicata.

Rami thyrsigeri diametro 3-5 mm, cortice subfusco. *Folia* circ. 16 cm longa totidem lata; foliola 10-12 cm longa, 4.5–5 cm lata, sicca subfusca; petiolus communis 3–4 cm longus, supra sulcatus, rhachis paullo brevior; stipulæ 2. 5 mm longæ. *Thyrsi* folia subæquantes, robusti, pedunculo quam rhachis tomentella longiore; rhachis (fructifera) diametro 2-2.5 mm, sat dense cincinnigera, cincinnis sessilibus contractis; pedicelli fructigeri 6-7 mm longi, paullo supra medium articulati. *Sepala* (calycis fructiferi) tomentella, duo exteriora breviora, interiora circa 4 mm longa. *Tori* glandulæ ovatæ, pubescentes. (Reliquæ floris partes non suppetebant.) *Fructus* stipite 5–6 mm longo adjecto

2.5–3 cm longus. *Semen* 1.3—1.4, cm longum, testa atro-fusca, pilorum endocarpii impressione leviter striolata, nitidula.—*Obs.* Affinis *Paulliniæ costatæ* Schlechtend. et Cham.

Boca del Cajabon, Dept. Yzabal, alt. 350, Apr., 1889, J. D. S. (Ex Pl. cit. 1662).

Spondias Radlkoferi.— Leaves 7–9 jugate, about a foot long; leaflets granular-punctate, the upper pairs oblong-lanceolate (30–38 × 10–13 l.), the lower rhomboidal and smaller, obliquely and acutely caudate, midrib and 6–8 costal nerves pubescent: pedicels bracteose at base, shorter than buds, clustered toward apex of short tertiary branches of panicle: calyx-lobes round-ovate, obtuse: disk fleshy, depressed, pulvinate, radiate, pulverulent: anthers small, quadrate: ovary 3–4-locular, styles pointed: fruit not seen.— A species, otherwise similar to *S. lutea* L., to which as probably new my attention has been directed by Prof. L. Radlkofer, the eminent monographer of *Sapindaceæ*.— Escuintla, Dept. Escuintla, alt. 1,100 ft., Apr. 1890, J. D. S., (Ex. Pl. cit. 2087).

Galactia discolor.— Fruticose, erect (2–3 ft.), cano-pubescent: stipules filiform; leaflets twice to thrice exceeding petiole, shortly and subequally petiolulate, coriaceous, green and glabrate above, silvery lanate beneath, lanceolate to elliptical-oblong (20–42 × 6–16 l.), the terminal the greater, acute or obtuse at each end, apex mucronate or retuse: racemes subsessile, short (10–18 l.); flowers 6–12, half an inch long, purple: calyx-tube shorter than pedicel and filiform bractlets, its segments 4 times longer and nearly equaling petals: the vexillary round-oval, auriculate, not inflexed, its filament free: ovary silvery lanate.— *G. Jussiæana* HBK., likewise with habit of *Collæa* and flowers of *Eugalactia*, differs chiefly by smaller elliptical leaves emarginate at base with the terminal one remote, minute stipules and bractlets, less deeply parted calyx twice exceeded by roseate petals, the vexillary obovate and exappendiculate.— Santa Rosa, Dept. Baja Verapaz, alt. 5,000 ft., July, 1887, v. Türckheim, (Ex Pl. cit. 1321).

Oreopanax oligocarpum.— Arborescent, nitidous except sparsely stellate-pubescent panicle: leaves crowded at apex of branchlets and at intervals below, exstipulate, coriaceous, entire, 3-nerved, lanceolate (6–9 × 1–1¾ in.), apex acutely produced, base acute, petioles from a third to more than half as long and tumid at each end: panicle sessile, corymbiform, subequalling petioles; heads small (in anthesis scarcely 2 lines in diameter), much exceeded by peduncles, loosely 5–8-flowered: of masculine flowers calyx obsolete, petals 4 and equalling filaments, styles united; feminine flowers not seen: berries 3–4 to a head, globose-ovoid, sulcate, 6–7-seeded, crowned with persistent radiate styles.—*O. capitata* Dcne. et Planch., a nearly related species, differs by stipulate leaves ovate to obovate, large diffuse panicle of shortly pedunculate many-flowered heads, petals 5, long-exsert stamens and free styles of masculine flowers.—Pansamalá, Dept. Alta Verapaz, alt. 3,800 ft., Apr. 1889, J. D. S., (Ex Pl. cit. 1743). Collected also by Sor. Juan Cooper near Cartago, Costa Rica, alt. 5,000 ft., Mch. 1888, No. 322.

Parathesis sessilifolia.—All parts except nitid upper surface of leaves rufo-tomentose with long-stipitate stellate hairs: leaves oblanceolate (6–8 × 1¾–2 in.), acuminately produced, tapering from above middle to acute sessile base, pergameneous, subcrenulate, both surfaces nigro-punctate and finely reticulate: panicle terminal, exceeding leaves, pyramidate, lower branches leaf-bracted: flowers 6–10, corymbosely fasciculate toward apex of secondary branches, subequalling pedicels, in all parts linear-maculate, filiform bractlets a half shorter: sepals acutely lanceolate (½ l.): segments of corolla linear-lanceolate (2½ l.), glabrous within, revolute: anthers affixed near base, oblong (1¼ l.), thrice exceeding filament: berry 4 l. in diameter.—Peculiar by indument and sessile leaves.—Coban, alt. 4,300 ft., Aug. 1886, v. Türckheim, (Ex Pl. cit. 1443).

Parathesis pleurobotryosa.—Fusco-tomentulose: leaves elliptical (4–6 × 1½–2 in.), ends similarly acute, subentire, glabrate above, epunctate, opaque, 14–18 costal nerves distinct: panicles axillary, equalling leaves, racemiform, short branches terminated by 3–5 umbellately clustered minutely bracteolate pedicels equalling scarcely maculate flowers: corolla-segments ochraceo-furfuraceous on both sides: anthers short (¾ l.), equalling filament: ovary smooth: berry not seen.—Anthers excepted flowers are similar in form and dimensions to those of preceding species. *P. melanosticta* Hemsl., (Ex Pl. cit. 1706), with inflorescence also strictly axillary, differs by glabrity, nigro-punctate oblong-elliptical leaves acuminate at apex and long-tapering into petiole with more numerous costal nerves uniting in marginal arches, compound panicles, ovate sepals, half smaller white maculate flowers, lanceolate corolla-segments smooth without and albo-furfuraceous within, pubescent ovary.— Santa Rosa, alt. 5,000 ft., Sept. 1888, v. Türckheim, (Ex pl. cit. 1,442).

Fimbristemma calycosa.—Leaves oblong-cordate (4–6 in.), abruptly acuminate: peduncles (6–10 l.) exceeded by petioles, the much longer pedicels cymosely and radiately 6–8 fasciculate, flowers an inch in diameter: segments of calyx oval, pallescent: segments of corolla somewhat longer, narrower, glabrous, dark-yellow, dextrorsely convolute: exterior crown lobeless, densely long-fimbriate; lobes of the interior ovate, equalling fringe, bidentate, naked: anthers appendiculate below with a bicornute wing, caudicle nearly as long as pollen-mass: follicle not seen.— *Fimbristemma*, as limited by Turczaninow and not of Bentham and Hooker, is represented by one other species, *F. gonoloboides* Turcz., which differs *ex char.* by peduncles exceeding petioles and bifid, half larger corolla twice exceeding calyx, lobed exterior crown, lobes of the interior entire and with an inner cucullate appendage, anthers tipped with a membrane. *Callæolepium Warscewiczii* Karst., cited by Benth. & Hook. as a second species of *Fimbristemma*, is maintained by its author to be generically distinct by form of crown, and to belong by position of pollen-masses to the group of *Cynancheæ* rather than to *Gonolobeæ*, (Botan. Jahrb. viii. 360).— Chucaneb Mt., Dept. Alta Verpaz, alt. 6,000 ft., Apr. 1889, J. D. S., (Ex Pl. cit. 1,500).

Explanation of Plate XVI.— Fig. 1. flowering branch. Fig. 2, flower with calyx and corolla removed. Fig. 3, exterior crown. Fig. 4, interior crown. Fig. 5, pistil. Fig. 6, pollen-masses. (Fig. 1 is natural size; the others are variously enlarged.)

Nephradenia fruticosa.— Erect virgate shrub 6–8 ft. high: leaves linear-lanceolate (6–8 × 1–1¼ in.), tapering acutely to apex and short (5–7 l.) petioled, eglandular, pale beneath, conspicuous arching veins about 15 to a side: cymes extra-axillary, scarcely half as long as leaves, pedicels exceeded by peduncle and 3–8-subfasciculate in one or two bracteose clusters: corolla rugose, 15-nerved, pale-yellow, 9 lines broad, semi-fid, tube twice exceeding oval ciliate calyx-segments, half-oval lobes naked and emarginate: processes of crown equalling gynostegium, half-free; the adnate half small, triangular, inflated and concavely bilobate at base, margin entire, prolonged into subulate free upper half; pollen-masses attached at base: stigma convex, exumbonate: immature follicle fusiform, tapering to long stipe.—*N. neriifolia* Benth. et Hook., the nearest congener, is a herbaceous perennial with linear-oblong leaves rounded and glandular at base, ciliate corolla, adnate coronal processes cymbiform, stigma umbonate.—Rocky islands in Rio Rubelcruz, Dept. Alta Verapaz, alt. 2,500 ft., May 1887, v. Türckheim, (Ex Pl. cit. 1,251); same locality, Apr. 1889, J. D. S., (Ex Pl. cit. 1,742).

Solenophora erubescens.—Glabrous, rubescent, tumid nodes marked by an interpetiolar line: leaves oval to elliptical-oblong, the larger in the pairs 2–3½ in. long, the other a third smaller, apex acutish, base inequilateral, coriaceous, rubescent beneath, indistinctly sinuate-serrate, petioles from ¼ to ¾ as long as leaves: flowers single on shorter axillary peduncles bibracteate in middle, or few in trichotomous cymes chiefly terminal: calyx coriaceous, 5-costate, rubro-maculate, obconic (9 l.), in flower ¼- and in fruit ½-adnate, lobes ovate (2 l.): corolla infundibuliform, twice exceeding calyx, yellow, ⅔-tubular, limb expanding to 8 lines broad; lobes suberect, transversely oblong (2 × 5 l.), the interior the greatest and pectinate-crenate: style 2-lobulate: fruit baccate, oval (5 l.), crimson, crowned with persistent 2-lobed gland.—Habit peculiar by glabrity and small leaves.—Rocks of a waterfall, Pansamalá, alt. 3,800 ft., May 1887, v. Türckheim, (Ex Pl. cit. 731); same locality, Apr. 1889, J. D. S., (Ex Pl. cit. 1,684).

Besleria Pansamalana (*Podobesleria* Benth. et Hook.).—Epiphytal, repent, ligneous branches ascending a foot or two, pubescent: leaves shortly petiolate, unequal in the pairs, obovate-oblong (5–6 in.), the lower smaller and obovate-rhomboid, acuminate, base obliquely acute, serrulate above middle, under surface pale-pubescent: peduncles single from one or both uppermost axils, half as long as leaves, 1-flowered: calyx-segments nearly distinct, ovate (4–5 l.), green, plurinerved, the 2 exterior narrower: corolla from narrow saccate base horizontally supine, ventricosely calceiform, 14 lines long, less than half as high, crimson; throat facing upwards midway between base and ventral apex, constricted (3 l.); divisions of small limb roundish, unequal, erect: genitals included: cells of anthers forming nearly a circle, connective orbicular: disk annular: style short (3 l.), ⅓-bilobed.—Related to *B. Onogastra* Hanst. by the corolla curiously resembling the lip of *Cypripedium*, but distinct by inflorescence, calyx, etc.—Pansamalá, alt. 3,800 ft., Jan. 1887, v. Türckheim, (Ex Pl. cit. 196); same locality, Apr. 1889, J. D. S., (Ex Pl. cit. 1,798).

EXPLANATION OF PLATE XVII.—Fig. 1, flowering branch. Fig. 2, corolla laid open. Fig. 3, stamen. Fig. 4, pistil. (Fig. 1 is natural size; the others are variously enlarged.)

Macfadyena simplicifolia.—Erect (12–15 ft.), compressed branchlets dichotomous, articulations of petioles and pedicels glandular: leaves simple, elliptical ($5-7\frac{1}{2}\times 2-3$ in.), acute at each end, beset with cystoliths: flowers few, opposite in terminal short racemose clusters, short pedicels little exceeding subulate bractlets: calyx lanceolate (18–22 l.), acuminate, in anthesis closed at apex and base: corolla twice longer, white, tubulose-infundibuliform, throat $\frac{1}{2}$ in. wide, lobes roundish (6–9 l.): oblong anther-cells divergent at base, staminode not present: disk cupular: stigma minutely lamellate: ovules 2 to each placenta, superposed, wings hyaline: capsule not seen.—Anomalous by erect habit, simple leaves and terminal inflorescence.—Borders of forest, Pansamalá, alt. 3,800 ft., Aug. 1886, v. Türckheim, (Ex Pl. cit. 1,030).

EXPLANATION OF PLATE XVIII.—Fig. 1, flowering branch. Fig. 2, corolla laid open. Fig. 3, pistil with half of calyx. Fig. 4, anthers. Fig. 5, stigma. Fig. 6, vertical section of ovary. (Figs. 1–3 are natural size; the others are magnified.)

Henrya imbricans.—Stems several from base, a foot or more long, decumbent, smooth, white, nodes verrucose: young leaves small (1 in.), ovate, acuminate, mucronate, long petiolate, pubescent: spikes short, densely flowered, 2–3-subfasciculate, axillary, or leafy-bracted in a long slender terminal panicle: bractlets simulating involucres, oblanceolate, mucronate; involucres a third longer (5 l.), imbricating, valves mucronate: corolla large (6 l.), exsert in bud: anther-cells elongate-oblong.—Both *H. scorpioides* Nees and *H. costata* Gray differ conspicuously from above by simply spicate loosely interrupted inflorescence; the former also by glandulose leaves acute at base, minute roundish bractlets, half smaller flowers, elongated style; the latter also by pluricostate shortly petiolate leaves, small cuspidate involucres.—Banks of Laguna Amatitlan, Dept. Amatitlan, alt. 3,900 ft., Febr. 1890, J. D. S., (Ex. Pl. cit. 1,923).

PISONIA ACULEATA L., var. **macranthocarpa.**—Spines infra-axillary, straight: pedicels of large (6 in.) cymes $1\frac{1}{2}-2$ in. long; fruit obovate (9 l.), half as broad, glands long-stipitate.—Escuintla, alt. 1,100 ft., Apr. 1890, J. D. S., (Ex. Pl. cit. 2,091).

Neea psychotrioides. — Fruticose (6–8 ft.), dichotomous, smooth except rufo-fuscous pubescence of younger parts and inflorescence, branchlets terete and grayish: leaves subopposite, 4-verticillate at forks, unequal in the pairs, equilateral, oblong (4–5 × 1¼–1½) in., acuminate, base rounded, petioles short (2–4 l.); corymbiform cymes long pedunculate from forks of branches, subequaling leaves, axes 3–5-approximated and in fruit divaricate, cymules 3-flowered; calyculate bracts 2–4, subulate (¼ l.), persistent: staminate perianth not seen; the pistillate nearly sessile, oval (2 l.), mouth contracted, rudimentary stamens 8–10, ovary globose, style subexsert, stigma dilated: anthocarp ellipsoid (3½ × 2 l.), compressed, pubescent, pluristriate, constricted below tomentulose limb. — *N. Wiesneri* Heimerl, nearly related as described and figured in detail (Botan. Jahrb. xi. 89, t. ii), differs by elliptic-lanceolate leaves dimorphous in the pair, terminal 2–3-chotomous open glabrous inflorescence, slender elongated pedicels, ovate-tubulous perianth, fimbriate stigma, glabrous terete anthocarp not striate. *N. oppositifolia* Ruiz et Pav., also related, is distinguished by elongated 5-staminate perianth, etc. — Escuintla, alt. 1,100 ft., Mch. 1890, J. D. S., (Ex Pl. cit. 2,069).

DALECHAMPIA SCANDENS L., var. **trisecta.** — Leaves glabrate, elobate and cordate-ovate, or chiefly trisect with petiolulate leaflets. — San Juan Mixtan, Dept. Escuintla, alt. 500 ft., Apr. 1890, J. D. S., (Ex. Pl. cit 2,079.)

Pirus (§ PSEUDOSTROBUS) **Donnell-Smithii** Mast. — Arbor altitudine mediocris vel humilis; ramulis crassis asperatis; squamis fulcrantibus 10–12 mm. long. subcoriaceis castaneis lanceolatis longe acuminatis margine laciniato-fimbriatis, fimbriis ascendentibus vix intertextis; fasciculis dense approximatis 5-phyllis basi vaginatis, vaginis circa 12 mm. long. e squamis lanceolatis pluribus constantibus, squamis infimis subcoriaceis ad margines integris sursum paulatim increscentibus, squamis mediis ad margines albidis longe fimbriatis, fimbriis horizontaliter divergentibus intertextis fasciculum obvolventibus, squamis summis hyalinis integris; foliis circa 13 cm. long. 1 mm. et ultra lat. rigidis triquetris ad angulos serrulatis apice subulatis, canalibus resiniferis parvis paucissimis sub epidermide positis ? vel nullis; stomatibus in utroque latere per series 6–7 dispositis; amentis masculis pluribus ad apices ramulorum capitatim-aggregatis, singulis 25–30 mm.

long. 5–7 mm. lat. erectis vel ascendentibus rectis cylindratis obtusiusculis basi bracteis subcoriaceis castaneis suffultis, bracteis infimis margine albido-fimbriatis, bracteis summis margine integris albido-limbatis; antherarum connectivis suborbicularibus erosis aurantiaco-purpureis; amentis feminiis pedunculo deflexo crasso impositis, curvatis cylindrato-conicis; squamarum apophysibus valde promimentibus deflexis carnoso-coriaceis irregulariter sub-5-angulatis carina transversa brevi notatis, medio depressis, umbone lato deltoideo deflexo; strobilis adultis pendulis circa 10 cm. long. 6-7 cm. lat. cylindrato-oblongis apice obtuse conoideis, (squamis autem siccitate a sese separatis strobilus ovoideo-subglobosus evadit); squamis lignoso-coriaceis crassiusculis apophysibus circa 10 mm. long. 16 mm lat. rhomboideis sub-pyramidatis apice cum umbone excentrico reflexis; seminibus circa 2 cm. long. 5 mm. lat. superne alatis, ala membranacea pallide fusca angusta oblonga margine hinc paullo crassiore recta illinc tenuiore falcatim curvata.—De hac specie insigni et, ut videtur, hactenus indescripta, nec non strobilorum squamarumque notis valde distincta ita in litt. scribit oculatissimus repertor: "Abunde occurrit versus cacumen montis, et etiam ad ejus culmen, ad alt. 12,300 ped. ubi autem arbor pumila 10-12 ped. tantum evadit." Cl. Godman etiam qui hanc speciem loco eodem observabit abhinc annos triginta tradit hancce arborem cingulam circa montem efficere ad alt. 10,000 ped. usque ad culmen aliis arboribus nullis intermixtis. In opere laudato auspiciis cl. Godman edito et a sollerte Hemsley confecto, cui nomen Biologia Centrali-Americana, vol. iii, arbor haecce obiter injecta est, nomine tamen et descriptione omnino praetermissis.— Summit of Volcan de Agua, Dept. Zacatepequez, alt. 12,300, Apr. 1890, J. D. S., (Ex Pl. çit. 2182).

On certain new or peculiar North American Hyphomycetes. II.

Helicocephalum, Gonatorrhodiella, Desmidiospora nov. genera and Everhartia lignatilis n. sp.

ROLAND THAXTER.

(WITH PLATES XIX AND XX.)

Helicocephalum nov. gen.—Sterile hyphæ of small diameter, aseptate or rarely septate, creeping over the substratum and giving rise to highly differentiated, erect, simple, aseptate sporiferous hyphæ furnished with rhizoid like attachments at the base and spirally coiled at the apex: the spiral portion becoming septate and constricted at intervals, its segments separating at maturity in the form of large, dark colored, thick walled spores.

Helicocephalum sarcophilum n. sp.— Plate XIX, figs. 1–5. Sterile hyphæ hyaline, creeping, branched, 2μ in diameter. Fertile hyphæ hyaline, 1 mm. or more in height, 20–25μ in diameter near the base and 8–10μ near the apex: tapering gradually upwards from a slightly swollen base: two or three times abruptly spirally coiled at the distal end, the spiral portion of large diameter and converted at maturity into a chain of seldom more than twenty-one spores, by the formation of successive septa. Spores brown, thick walled, with finely granular contents, asymmetrical, usually obliquely truncate, or not evenly rounded, at either end; at first hyaline then brown, $55 \times 30\mu$ (maximum $65 \times 35\mu$), separating and ultimately cohering in a viscous, rounded mass.

On carrion. Connecticut.

This remarkable form made its appearance on a laboratory culture in company with *Cœmansiella spiralis* Eidam. It is not gregarious, appearing here and there on the substratum, and closely resembles a large Mortierella or Syncephalis; the spiral portion holding a drop of somewhat viscous fluid, which gives it the appearance of a large spherical head (fig. 1). The spores mature simultaneously, falling apart and cohering as shown in fig. 4. They are very thick walled and all attempts to germinate them in nutrient media proved fruitless.

The relations of this plant are quite uncertain, no fungus which appears even remotely connected with it being known to the writer. It is placed here among the Hyphomyceteæ from lack of evidence which would refer it elsewhere. In its mode of growth it recalls Mortierella and similar forms: but its type of spore formation, as well as the character of its spores, is quite distinct from that which occurs in any of the genera of Mucoraceæ; among which, however, it is not impossible that it may eventually find a place.

Gonatorrhodiella nov. gen. — Sterile hyphæ hyaline, creeping, septate and branched. Fertile hyphæ erect, sparingly septate, swelling into a spherical terminal sporiferous head, which after maturity may become once or twice proliferous, the proliferations also forming similar proliferating heads, the resulting hypha presenting ultimately the appearance of a successively inflated filament. Spores formed directly from short processes covering the fertile head, in chains of a definite number, by successive apical budding.

Gonatorrhodiella parasitica n. sp. — Plate XIX, figs. 7–10.

Fertile hyphæ gregarious, simple or rarely dichotomously branched, sparingly septate, hyaline becoming pale fawn colored, seldom more than five times successively proliferous, 8–12μ in diameter, sometimes more than 1 mm. in height. Sporiferous head nearly spherical to oval, rarely producing more than a single proliferation, 25–35μ in diameter, maximum $43 \times 36\mu$. Spores in chains of three, hyaline, then fawn colored, oval to elliptical, caducous, $8.5 \times 6 - 12 \times 7\mu$ the basal ones the largest.

On Hypocrea and Hypomyces. Connecticut.

This species has been met with in several localities about New Haven always growing directly upon, or running a short distance from certain species of Hypocrea and Hypomyces on which it appears to be parasitic. The genus is distinguished from *Gonatorrhodum* Corda, to which it bears a superficial resemblance, by the absence of the large, septate, subverticillate "ramuli" which give rise to the spores in the last named genus; as well as by its definite spore formation, the indefinite and often branched spore-chains of Gonatorrhodum being replaced by short simple chains composed of a small and invariable number of spores. Whether the successive apical formation of the spores in the present genus does not constitute another essential difference, cannot be determined from Corda's description; but from his figure as well as from analogy with other genera, like Aspergillus, Verticillium, etc. to which he compares it, a successive basal spore formation may be inferred in Gonatorrhodum from the large basidia or "ramuli," as well as from the spore of the primary chain from which a secondary chain occasionally springs. The present genus is purely Mucedinous; while, as Saccardo remarks, Gonatorrhodum seems rather to belong among the Dematieæ.

Desmidiospora nov. gen.—Spores of two kinds, on the same mycelium of hyaline septate hyphæ: microconidia, small, hyaline, subfusiform, produced at the apex of subulate lateral basidia: macroconidia very large, terminal, brown, flat, multilocular, several times successively, more or less irregularly, dichotomously lobed.

Desmidiospora myrmecophila n. sp.— Plate XX, figs. 1–9. Hyphæ much branched and septate covering the host in a white flocculent mass. Microconidia subfusiform, slightly asymmetrical 12 × 2–2.5 μ, produced sideways at the apex of subulate basally inflated basidia. Macroconidia terminal, short stalked, three to five or even six times successively dichotomously lobed, irregularly multilocular, very thick walled, reddish brown or fawn colored, 80 × 68 μ, maximum 100 × 90 μ. 12–14 μ in thickness.

On a large ant. Connecticut.

This remarkable plant has been met with only once growing luxuriantly on a large black ant which was found fastened to the under side of a rotting log. The hyphæ emerged especially from between the abdominal segments, enveloping the insect more or less completely and extending a short distance over the substratum. It is not impossible that this may be an imperfect form of some Cordyceps, perhaps *C. unilateralis* Tul., which is the only species of the genus that the writer has observed on ants in this vicinity. No analogous form, bearing the same relation to Cordyceps that Mycogone or Sepedonium, for instance, are supposed to bear to other Hypocreaceous genera, has been observed, as far as known to the writer. The microconidia in the present instance are, however, certainly very similar in appearance and mode of formation to conidia known to be associated with certain species of Cordyceps: yet the connection cannot be assumed and the use of a new generic name seems unavoidable. It is not unlikely, moreover, that the fungus under consideration may be mycophilous and like certain species of Gymnoascus, Thielavia, Melanospora, etc., which so often interfere with artificial cultures, be parasitic on an immature Isaria or Cordyceps previously developed within the insect.

Everhartia lignatilis n. sp.—Plate XX, figs. 10–12. Scattered, superficial, stipitate or substipitate, yellowish becoming blackish towards the base, subcylindrical or expanding upwards, 250–400 × 100–150μ. Spores hyaline, terminal, 3-septate, cylindrical or slightly flattened, 4μ in diameter, the rounded base and snout-like apex approaching one another in a single convolution 12–13 × 8–9μ: extruded in a yellow viscous rounded mass. Sporiferous hyphæ septate, subdichotomously branched, mingled with longer usually simple sterile hyphæ.

On wet logs. Connecticut.

This species occurs not uncommonly about New Haven on very rotten wet logs. It differs from *E. hymenuloides* Sacc. & Ell. in being stipitate as well as in its very distinct and smaller spores. The latter are produced in enormous quantities adhering to the apex in a yellowish viscous drop. The spores germinate readily in water, producing single hyphæ from the convexity of each segment.

EVERHARTIA HYMENULOIDES Sacc. & Ellis.—Plate XX, figs. 13–14.—Figures of the spores of this species are given for comparison drawn from material distributed in Ellis N. A. F. No. 969 on dead leaves of Sorghum nutans. In this species the sporodochia are sessile and ill defined, the spores being produced terminally on short simple hyphæ (fig. 14). The spores are formed in a helix of several convolutions, 16 × 20μ, and are about 3.5–4μ in diameter, extruded in a viscous mass and surrounded by a coarsely granular greenish mucus.

EXPLANATION OF PLATES.

Plate XIX.—*Helicocephalum sarcophilum*, n. sp.—Fig. 1. Nearly mature plant showing general habit, with rhizoidal attachment at base and drop of viscous fluid held by the spiral. ×136. Fig. 2. Spiral portion enlarged, ×232. Fig. 3. Young spiral before division has commenced, ×200. Fig. 4. Spiral after maturity, the spores separated and cohering in a viscous mass, ×232. Fig. 5. Two mature spores, ×696. Fig. 6. A spore in optical section, ×696.

Plate XIX —*Gonatorrhodiella parasitica*, n. sp. Fig. 7. Fertile hyphæ, showing single and double proliferation, the left hand head mature, the right beginning the fifth proliferation, ×232. Fig. 8. Portions of two fertile hyphae, one simple and showing mature spore chains *in situ*, the other furcate and immature, ×348. Fig. 9. Mature spore chain, ×696. Fig. 10. Spore chain showing budding of apical spore, ×696.

Plate XX.—*Desmidiospora myrmecophila*, n. sp.—Fig. 1. Portion of hyphæ showing microconidia on subulate basidia, ×348. Figs. 2–6. Showing successive stages in the development of the macroconidia, ×348. Fig. 7. Macroconidium in which the transverse walls are partly formed, ×348. Fig. 8. Two mature macroconidia, ×348. Fig. 10. Macroconidium viewed horizontally, ×348.

Plate XX.—*Everhartia lignatilis*, n. sp. Fig. 10. General habit showing rounded mass of extruded spores, ×68. Fig. 11. Sterile and fertile hyphae of sporodochium, showing stages in formation of helicospores, ×464. Fig. 12. Mature spores, ×696.

Plate XX.—*Everhartia hymenuloides* Sacc. & Ell. Fig. 13. Mature spores, ×696. Fig. 14. Spore *in situ*, showing terminal formation, ×696.

Notes on North American Mosses. II.

CHARLES REID BARNES.

DICRANUM PALUSTRE LaPyl.—This species has not been noted as particularly variable as is the case with its congener, *D. scoparium* Hedw. The examination of a large series of specimens, collected in various parts of the northwestern United States by Dr. Julius Röll in 1888, has shown me that it is almost as polymorphous as D. scoparium, and that it intergrades so closely with that species that it is quite impossible to limit it except in a wholly arbitrary way. The var. *paludosum* of D. scoparium imitates somewhat the typical D. palustre in the rugulose and shorter pointed leaves. But this is a character by no means constant in the latter species. Indeed it is oftener absent than present. There is also no reliable distinction to be drawn from the section of the costa. We have therefore simply to say that those forms with slender pointed often falcate leaves, having the cells somewhat elongated in the upper part, shall be grouped with D. scoparium. I have not thought it worth while to characterize separately any of those forms of D. palustre (among which the Californian variety *Brewerianum* of Lesquereux may well be placed) which connect with the palustral modifications of D. scoparium. If one should begin, the list might rival that of some of the Sphagna! On the other hand D. palustre shows numerous variations toward forms with broad leaves, entire or coarsely serrated and usually not wrinkled. Three of these I have separated as well-marked varieties,[1] which fall more or less closely into company with the European vars. *juniperifolium* and *polycladon* of the Bry. Eu. Had the intermediate forms been lacking from the collection I should have unhesitatingly established these, or at least the var. *Roellii*, as species.

Having already examined a considerable number of the species of Dicranum in determining the Weisiaceæ of Röll's collection, I hope to study the remaining North American members of the genus shortly.

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[1] Botanisches Centralblatt xliv. 386 (1890).

BARBULA MEGALOCARPA Kindb.—This is the same as *B. ruralis* var. *gigantea* Aust. MS. It is hardly worthy even of varietal rank. Indeed B. ruralis is described by Limpricht[2] as having the awn often reddish and the leaves "*meist* mit vorgezogener, *selten* gerundeter oder ausgerandeter Spitze"—characters on which Kindberg chiefly bases his B. megalocarpa.

WEBERA NUTANS Hedw.—In specimens collected by J. M. Holzinger at Winona, Minn., the cilia are as strongly appendiculate as in any Eu-Bryum. Of course such a statement without qualification would simply throw doubt upon the determination. But in this case there can be no mistake. Leaves from the very perichætium whose fruit was examined were used.

ATRICHUM ANGUSTATUM Br. & Sch.—Intermediate forms between this species and *A. undulatum* Beauv. are not uncommon, and some specimens from Washington, D. C., show lamellæ as much as 9 cells wide! One of the striking features of *A. Selwyni* Aust., of which abundant material has lately been received from the north-west, is the wide lamellæ, but they do not much surpass those on the specimens just referred to.

HYPNUM (Thuidium) PYGMAEUM S. & L.—The stems of this species are described as papillose. These "papillæ" are really short, 2—4-celled, papillose, filiform, rudimentary paraphyllia. They resemble in many ways most of the paraphyllia of H. minutulum, but are less developed. To call them "papillæ" is a misuse of the word.

HYPNUM (Claopodium) RAMULOSUM Hampe.—I think it probable that this is identical with Hooker's H. crispifolium. This opinion is not based upon a comparison of specimens for they are inaccessible, if indeed they exist. But authentic specimens of H. crispifolium agree perfectly with Hampe's (or Müller's) description.[3] Moreover this species is common in the region from which the supposed H. ramulosum comes, while that has never been collected but once. Specimens under this name in the James herbarium from Marin co.,

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[2] Die Laubmoose (Rabenh. Krypt.-Flora iv.) i, 687.

[3] Mueller: Synopsis Musc. ii. 486.

California, are H. crispifolium. Finally, the descriptions themselves of the two species show no points of specific difference.

HYPNUM (Camptothecium) NUTTALLII Wils.—This species often has the seta twice or thrice as long as the capsule, instead of "scarcely as long". This is shown by the specimens in at least two sets of Sullivant and Lesquereux' Musci Bor. Amer. I. n. 338b, and also by Macoun's n. 280 Canadian Musci, issued under the name of *H. pinnatifidum* S. & L.

HYPNUM (Isothecium) BREWERIANUM Lesq.—The leaf-cells are short-ovate to rhombic. If it is to be retained under Isothecium the subgeneric character "areolation minute, vermicular-oblong" must be corrected.

HYPNUM (Eurhynchium) COLPOPHYLLUM Sull.—This species has two forms of leaves which often occur on the same plant. The younger are the narrower (ovate to lance-ovate), while the older are broader (elliptic). The narrow form approaches most closely the figures of Sullivant's Icones Muscorum Suppl. pl. 71; the wider are more like those of *E. crassinervium*, but differ from them in the points named in the Manual, p. 353. These narrow leaves often predominate, in which case the aspect of the plants is quite different, so much so as to warrant a distinctive name. This narrow-leaved form of H. colpophyllum may be designated as var. **flagelliforme** n. var.: *leaves lance-ovate, small; branches long, almost flagelliform, attenuate.* In the type the branches are short and tumid-julaceous, leaves densely imbricate and elliptic-ovate. The apiculus is often very short, or the leaves may be simply acute. There is a considerable variation also in the size of the capsule.

NEW LOCALITIES.—The following new localities may be selected from a large number as being of special interest.

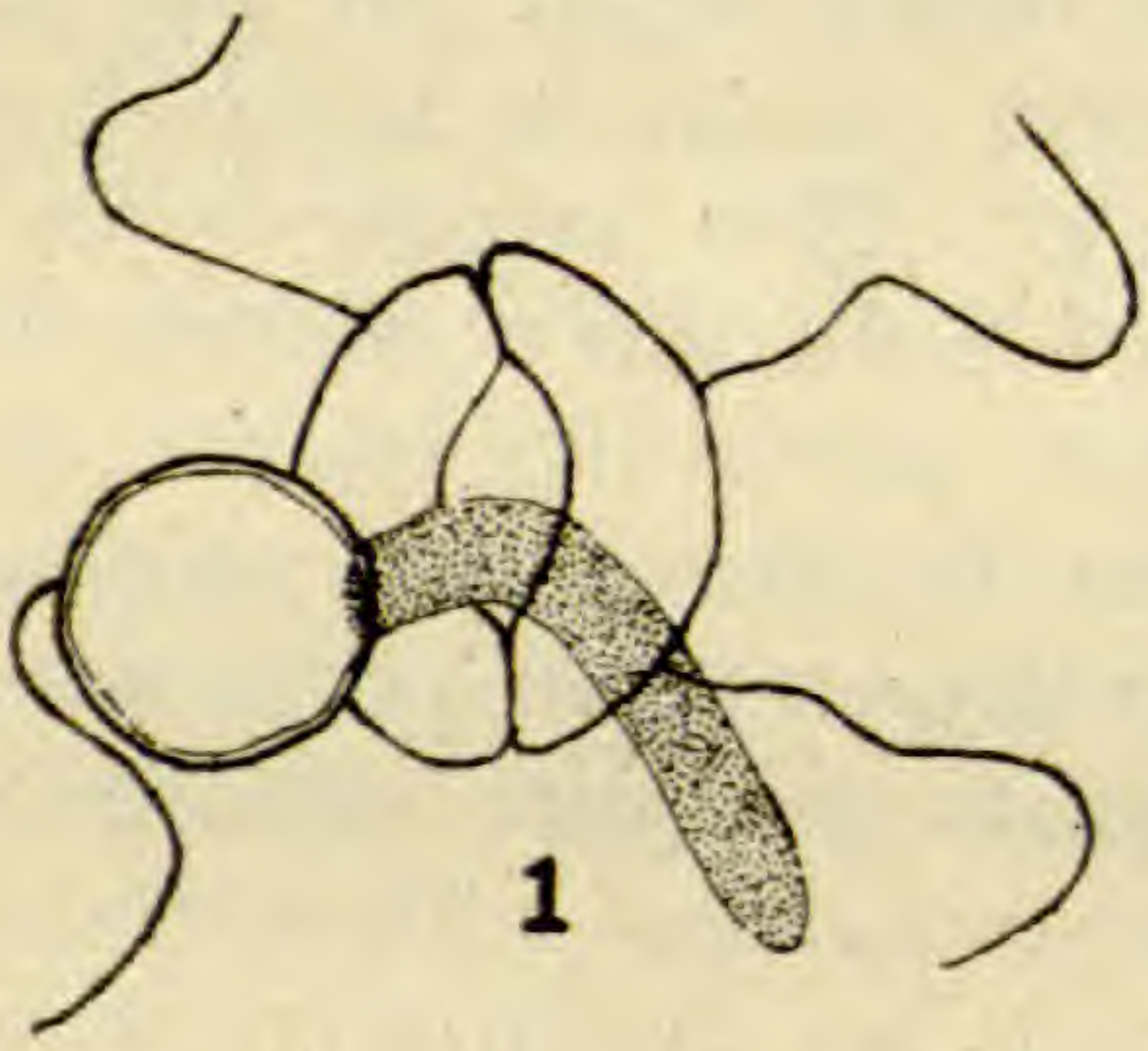
Bruchia Hallii Aust. has recently been sent me from Hockley, Texas, by Mr. F. W. Thurow, an interesting rediscovery of one of Hall's Texan mosses.—*Dicranum hyperboreum* Müll. was collected for the first time in the United States by Röll on Mt. Hood at 7000 ft. altitude.—Mr. J. M. Holzinger gathered a Coscinodon at Winona, Minn., which on comparison with the types proved to be *C. Raui*, previously credited only to Colorado.—The same excellent collector sent also from this locality *Fabronia pusilla* Raddi, *Myurella Careyana* Sull. and *Leskea Austini* Sull.

University of Wisconsin.

BRIEFER ARTICLES.

Penetration of the host by Peronospora gangliformis.— While studying the lettuce mould in the fall and winter of 1890, some observations were made by the writer on the penetration of its germ-tubes that differ from those heretofore recorded.

Spores of the fungus were sown in a drop of water upon the under surface of leaves of lettuce (*Lactuca sativa*). The leaves were kept in a moist atmosphere under a bell-glass in the laboratory. After twenty-four hours pieces of the epidermis were stripped off from the infected spots and examined under the microscope. The spores had germinated abundantly, pushing out a strong germ-tube into which the protoplasm of the spore had passed, leaving the empty, and often shriveled-up spore membrane attached to the germ-tube.



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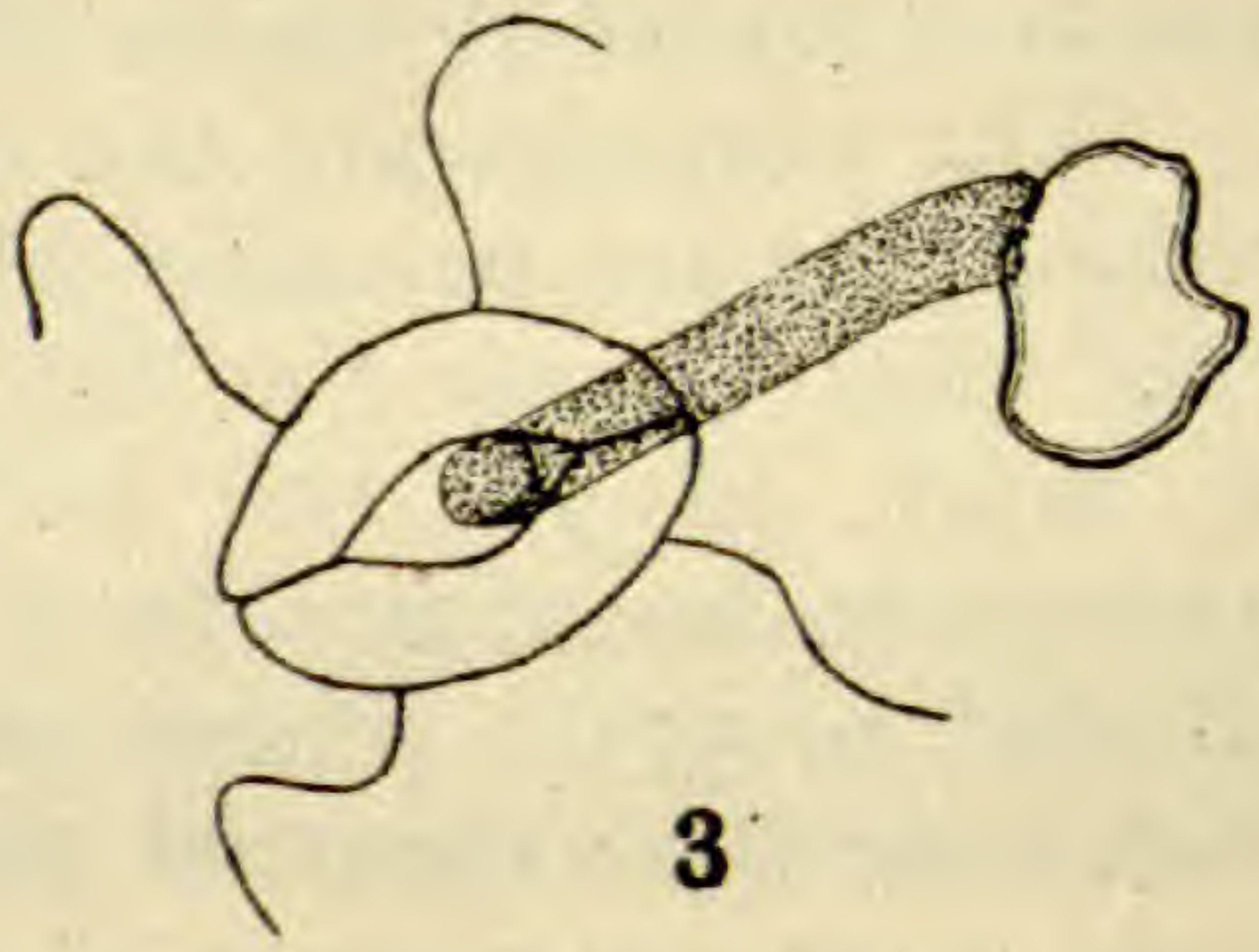

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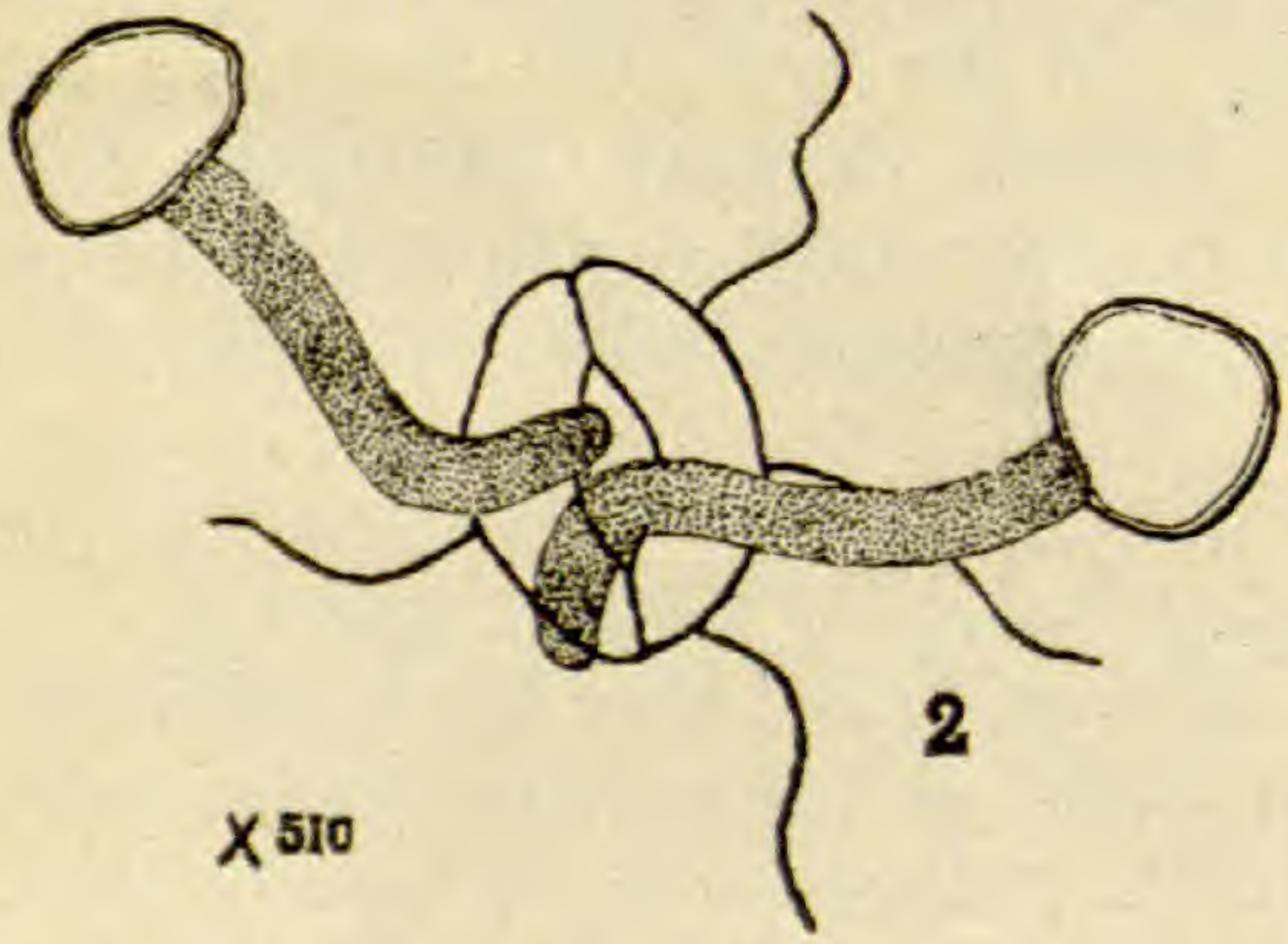

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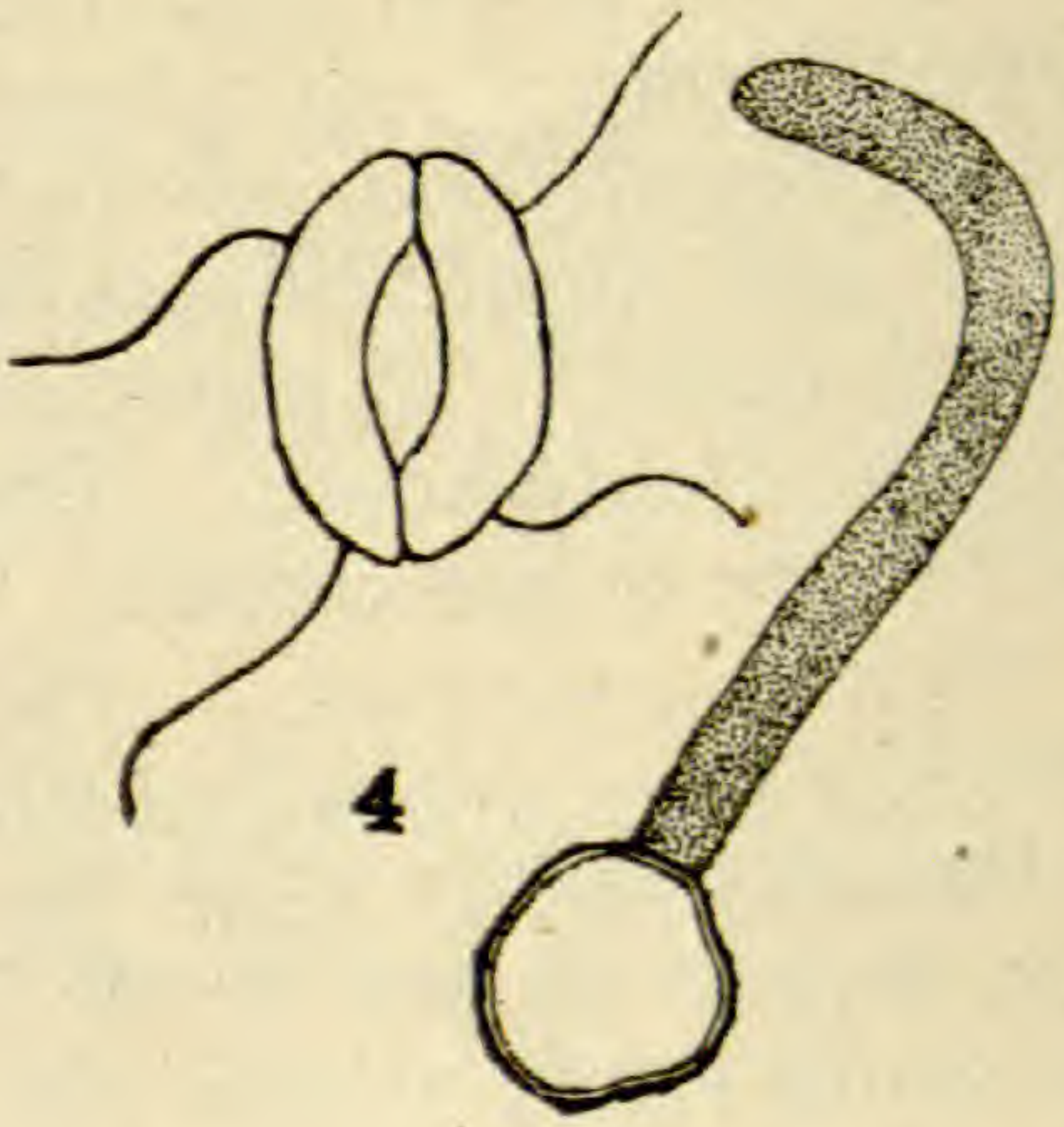

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Several cases of penetration were seen, the germ-tubes pushing their way between the guard-cells of the stomata (figs. 1, 2 and 3). In other instances the germ-tubes had approached quite up to a stoma, but had not yet penetrated (fig. 2). Very many of the germ-tubes had grown straight forward for a time, and had then made a rather sudden turn, directing the terminal portion toward a stoma in the vicinity (figs. 2 and 4).

These observations are confirmed by those of Mr. A. J. Pieters, who obtained results from sowings of spores upon leaves of a growing plant. No cases of penetration through the walls of epidermal cells, as is said by De Bary[1] to be the rule for this species, were observed.— W. H. RUSH, *Botanical Laboratory, University of Michigan.*

EDITORIAL.

BOTANY is making a healthy and vigorous growth in the United States. Never before have there been so many teachers, so many investigators, or so many collectors advancing the interests of the science and making its merits known to the public, as at the present time. Probably no field of the science is now wholly without workers, a statement that could not have been made a few years ago; and what is really more to the purpose, a constantly increasing proportion of the work accomplished has a permanent value and attains a rank of commanding importance.

THE ORGANIZATION of the Botanical club of the A. A. A. S., in 1883, gave a decided impetus to American botany, and especially effected an improvement in the character of the investigations undertaken by individual workers. The movement set on foot last year in the same association, by which a prearranged series of papers covering certain portions of the higher grounds of the science is presented each year, must also prove valuable. These and other means for raising the standard of work for the individual, and for strengthening the reputation of the science among its friends, have already shown good results and justified the efforts put forth.

SO MUCH has already been accomplished that even greater things may be confidently looked for in the future. The coming meeting at Washington, which promises to have a larger attendance of botanists than ever before, should bring forth some new plans for general or co-operative work. Things may be accomplished by the united interest and effort of the many that would be difficult or impossible for single workers. So plain a truth needs no illustration, but its appreciation in solving specific problems may require considerable enforcement.

A MATTER to be borne in mind for the coming meeting is the unique opportunity afforded by the approaching World's Fair to secure some benefits for botany. A few European visitors of eminence may certainly be expected, and an unusually full gathering of American botanists. Hundreds of industrial and other societies are arranging for memorable occasions, and if some of this enthusiasm could be turned in the direction of pure science the result could not fail to be beneficial.

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[1] Ann. d. Sc. Nat. Bot. sér. 4. xx.

ANOTHER matter not quite as distant may be suggested here. In connection with the papers upon physiological subjects at the Washington gathering, why not exhibit a collection of physiological apparatus? If each laboratory would send a few pieces the display would be made very interesting.

CURRENT LITERATURE.

Practical Botany[1].

The first edition of the Strasburger's Kleine Botanische Practicum published in 1886 has been one of the most useful of the handbooks of recent years. It had its defects, some of which were pointed out in this journal (vol. xii. 91) but they were not such as to seriously impair its usefulness. In this revised edition the author has much improved the book. Considerable additional matter has been inserted, notably in chapters xi, xxii, xxiii, xxvii, xxviii and xxx, and chapters ix and xxi have been almost entirely rewritten. Altogether 52 pages have been added and there are about 20 new figures. It is extremely difficult to make such extensive changes fit in with the old stereotyped plates. This has been done however with a minimum of injury to the appearance of the book, only a few pages being unduly leaded. One could have wished however that so many of the page numbers had not been carried to the inner edge of the page, and that when change was being made these might have been transferred where necessary so as to stand in their proper place.

The figures of the present edition are much better printed than in the first. They now compare favorably with those of the German edition. In every way the book is well manufactured. The suitable paper and loose binding are especially commendable in such a laboratory guide. We hope that it may by reason of these betterments meet with a still wider sale in this country.

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[1] STRASBURGER, EDWARD,—Handbook of practical botany, for the botanical laboratory and private student. Edited from the German by W. HILLHOUSE; revised by the author, and with many additional notes by author and editor. Second edition, revised and enlarged. 80 pp. xxiv. 425 (+ 52) figs. 149. New York: Macmillan & Co. [London: Swan Sonnenschein & Co.] 1889.

The new Gray's Manual.[1]

The revised (6th) edition of the Manual has been fully noticed in this journal (xv, p. 71). No one who has had any experience in bookmaking was surprised that there should occur a considerable number of errors and omissions in the first issue of this edition and some of the reviews of the book would have been less absurd had their writers taken some account of human fallibility. In this second issue an attempt is made to give "all such needed emendations of every kind as have come to our [the authors'] notice. Whenever it could be conveniently done these alterations have been made in the plates." The remainder are printed on four pages following p. 735 (designated 735 *a*, etc.) The corrections in the plates are numerous—over 100 of one sort and another. Seventeen species appear among the "supplementary additions and corrections"—and two genera, Franseria and Paulownia.

The pocket edition of the Manual is a gem in its way and certainly "fills a long-felt want." It weighs only 14 ounces and is about ⅞ of an inch thick—just the thing for carrying easily. It is bound in delightfully soft flexible leather, and looks as though it would be durable. We can suggest only one improvement short of India paper and silk-sewing—that is, slightly rounded corners, so as not to catch on the pocket. No botanist who has a copy of the library edition will ever carry that with him after he has seen this. The American Book Company has merited our gratitude for dressing this volume so serviceably and at the same time so handsomely. The *very low* price ($2) will certainly make this as popular as it is handsome.

Introduction to the Study of Botany.[2]

He who gets an introduction to the science of botany through the medium of this book will probably have little inclination to cultivate the acquaintance. If this book is a fair indication, Mr. Edward Aveling, D. Sc. (God save the mark!) has need himself to be introduced to the fair science whose most difficult task he has essayed without adequate knowledge.

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[1] GRAY, ASA.—Manual of the botany of the northern United States. Sixth edition, revised and extended westward to the 100th meridian by Sereno Watson and John M. Coulter. 8° cloth. pp. 760 (+ 4). plates xxv. New York: American Book Co. 1891. $1.60.

The same, pocket edition, 4¾ × 7½ inches, full leather, flexible. $2.

[2] AVELING, EDWARD.—An introduction to the study of botany. 12° pp. iv. 363. figs. 271. London: Swan Sonnenschein & Co. (N. Y.: Macmillan & Co.), 1891.

The book takes as its "basis the syllabus of subject xv, botany, from the Science and Art Department" of South Kensington, and proceeds to expound the science from this "examinational" standpoint. It is perhaps a fair inference that this "basis" is somewhat narrow, for we read early: "Broadly, biology is the science that deals with living bodies. General biology, as understood *in the examinational sense,* considers certain typical living bodies in their structure and life-history." We should have no quarrel, however, with the basis, were the superstructure sound.

In the body of the book eighteen flowering plants are described with considerable detail, the object, apparently, being to introduce as many terms, with their definitions, as possible. Then follow chapters on the vegetable cell, cell contents, tissues and systems, the root, stem, leaf, inflorescence, floral organs and fruits. A glossary — are we never to get rid of this as the animus of elementary botanical text? Not content to have the book mainly such, the author urges "upon the student and teacher the importance, the necessity, of everyone constructing his own glossary. The earnest student will, as he meets with each new word, then and there enter it in his vocabulary. At the end of this volume will be found a glossary put together by me, and this the student can compare with his." Here is a sample of it:

WORD.	DERIVATION.	DEFINITION.	EXAMPLE.
Thorn.	. . . .	A modified organ, hard and sharp.	Sloe.
Tissue.	. . . .	A constituent of an organ.	Parenchyma or muscle.
Tripinnate.	tres, three; pinna, a leaflet.	Divided into three leaflets.	Leaf of hemlock.

It is to be hoped that the student will succeed better than the author, for of the three definitions, selected at random within a space of seven lines, not one is accurate. And why should not the derivation of "thorn" and "tissue" be sought out, as well as that of words with Greek and Latin roots? But what is the use of any of it? Would a student of English literature be urged to construct for himself an English lexicon?

Dr. Aveling makes much of derivations however. Witness the following: "The upper [leaves] have no stalk or petiole, and are therefore said to be sessile. *Sedeo, sedi, sessum, sedere,* I sit." Why omit the rest of the conjugation? "The particular kind of inflorescence is therefore a *corymb.* κορυμβος, (*korumbos*) a cluster of fruit, especially of ivy-berries (Vergil, 'Bucolics,' Ecl. iii. 39)." To which the skeptical are respectfully referred. And this (verbatim) is particularly good: "the Orpine is of the order Crassulaceæ, thus named from the thickness of its leaves. *crassus,* thick. Species, *Sedum;* genus, *Telephium. Sedum,* from the sessile nature of the genus; *Telephium*, in the old over-classical fashion, from Telephus, the son of Hercules."

The author is evidently enamored of tabular arrangement, for he introduces tables, big and little, fragmentary and complete, at every available point.[1] Here is one at random, from which their value may be judged: "The fruit of the hazel can be worked out by reference to the fragment of the complete table given on p. 137." Then the entire page 137 is devoted to this, by means of which the fruit of the hazel ought to be "worked out" without severe mental strain:

FRUITS
- monogynœcial.
  - simple.
    - syncarpous.
    - apocarpous..
      - each carpel with one seed.
        - superior.
        - inferior.
      - each carpel with more than one seed.
  - compound.
- polygynœcial.
  - superior.
  - inferior.
    - 1-celled, with cupule—GLANS.
    - 2-celled.

Page after page is covered with these "fragments," which are gathered up, warmed over and spread out again in later " tables."

As specimens of the information imparted by this "introduction" read the following:

"The common name for the gynœcium [of the Buttercup] is the pistil."

"Consider now only one carpel. It is clearly monogynœcial."

"Raceme . . . *Racemus*, a bunch of grapes, one of the best examples of this kind of inflorescence."

" . . . glaucous. This last word is used for a surface of excessive, shiny smoothness."

"The rootstock of the Cyclamen is a tuber. The most familiar example of a tuber is a potato. The tuber of the Cyclamen is a rootstock structure; that of a potato is formed from a branch . . . and is therefore a stem structure."

Here is a bit of technique: "And even in their case [leaves of Sedum and Hyacinth] it is wise to cut up the leaf into fragments, throw the pieces into melted paraffin, and when this has cooled and solidified, make thin sections through this and the embedded leaves." The naiveté of these directions will be very impressive to those who know the paraffin process.

After five pages on these subjects, good, bad and indifferent, the author avers that "The cell-wall, protoplasm, nucleus, starch grains, aleurone grains are now understood." That and the following which comes from near the close of the book must prove very cheering to the weary student: "If the student will now turn to the syllabus of the

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[1] No less than 10 per cent. of the pages are occupied with such tabular views. Another 10 per cent. the glossary takes.

Science and Art Department printed in our first chapter, he will see that we have cleared off [but not up] not only the whole of the general morphology, histology and physiology, but also . . . ."

Here is the beginning of the discussion of vessels: "A vessel in botany [sic] is formed out of a number of cells placed vertically one above the other, whose partition walls vanish. The simplest kind of vessels are *vasa propria* (vessels proper)—elongated cells with a thickening of the wall that takes the form of a very fine network. The student will note once again how artificial our definitions are, and how the botanical categories overlap each other. A vessel is defined as a tube formed by the fusion of several cells, and the first kind of vessel described, *vas proprium*, is made up of one cell. The second form of vessel is the sieve tube. . . . sieve tubes are also called vesicular or utricular vessels. They are common in the bulb of the onion . . . and other Monocotyledons. The sieve tubes contain a milky juice and very often crystals."

The physiology is no better: " . . . the roots take in the nitrogen-containing food-stuffs and the leaves especially take in the carbon-containing food-stuff. From the roots the former must move up until they meet the latter coming down from the green parts. When the two sets of food-stuffs meet, the manufacture of those important plant structures that contain carbon, hydrogen, oxygen, nitrogen, must occur, and from the place where this manufacture occurs, diffusion of these substances to other parts of the plant must follow. . . . This taking in of food is assimilation."

But to continue would be to occupy space to no good purpose. What we have given is not a selection of isolated blunders. It might be increased ten-fold without exhausting the supply of error and absurdity. Some of the illustrations, could we reproduce them, would be as ludicrous as the text.

We should be glad to be able to say something favorable about this book, if, even after careful search, we could find it. But the plan is crude and the execution wretched. Yet if we do not mistake the tone of the book the author feels that he has done a creditable piece of work, and the publisher hopes to gain for it a sale in this country. It is a pity that so reputable a house should be so imposed upon by a worse than worthless text-book.

OPEN LETTERS.

The Manchester group of botanists.

A PHOTOGRAPH of twenty-five botanists was shown at the Indianapolis meeting of the A. A. A. S. and a number of persons expressed a desire to obtain copies of it. As an accommodation to those who may wish a copy, I will send an order to the photographer for as many as are wanted, and distribute them upon their arrival.

The group was taken at Manchester, England, in 1886, and was the company who gathered at the hospitable home of Prof. Williamson to do honor to the visit of Dr. Asa Gray. All departments of botanical science were represented. The group embraces: Messrs. McNab, Jessen, Treub, Solms-Laubach, Weissmann, Saporta, Baker, Lankester, D'Arcy Thompson, Dyer, Cohn, De Bary, Williamson, Asa Gray, Pringsheim, Carruthers, Gardiner, Oliver, Vines, Marshall Ward, C. Bailey, Balfour, Bower, Potter and Vaizey. The picture is 10 by 12 inches, and an excellent portrait of each individual. The price will be $1.35 unmounted or $1.75 mounted on a neat card 14 by 16 inches and the names written underneath. Those wishing copies will please send in their names as early as possible.—J. C. ARTHUR, *La Fayette, Ind.*

Monomialism.

I like the tone of the editorial in the May GAZETTE upon nomenclature. The propagators of this new fashion of naming plants are so confident of suceess and have so often predicted that the whole botanical world must make unconditional surrender, that I hasten to express my own feeling in the matter before my guns are spiked and my arms confiscated.

I suppose that the object of a name is to afford some ready and tolerably permanent means of designating a particular plant. And we have always been taught that it is no part of any system of nomenclature to give credit to any person. An author's name is attached to any plant for the simple purpose of identifying the plant name and we are also taught that the oldest name of any plant must stand. In order to meet these various requirements, botanists have been in the habit—erroneously, it now turns out—of employing two words to designate the plant, and this has been known as the binomial system of nomenclature. But now they are telling us that these two words do not constitute *the name* of the plant, but that *the name, per se*, is the second word of the two. In other words, *saccharinum* is the name of the sugar maple, *Canadensis* is the name of a Cornus—although one of my botanies declares that it is the name of a rush and even of a spruce!—and that *repens* is the name of white clover. This is the monomial system of nomenclature, and its devotees are delving through every author in the hope of finding *the name* of the plant. When this name is found—or supposed to be found, which amounts to the same thing—it is attached to some generic name to which it was never designed to fit, and the twain, to which an algebraic formula has been attached, is given to the world as the monomio-binomial name of the plant.

Now there is only one reason why I object to all this, and that is that it serves no purpose. It adds nothing to the stability of the name but rather weakens it. In many cases we can hardly hope to find the oldest specific name which chanced to be applied to the plant, and we can seldom be sure that we have found it, while it is a comparatively easy and sure process to find the oldest binomial. I deny the proposition that the specific name is *the name.* It does not designate the plant and therefore fails to satisfy the first demand of a name. The binomial answers every requirement of the definition of a name, and it has the distinct advantage of dating from a definite point,—the work of Linnæus. But if we once begin to attach the oldest specific name to any genus whatever — as the fashion of the time may determine — there is no reason why we should stop our search for specific names with the time of Linnæus. In fact, some botanists are even now advising the use of names from the old herbalists, and the system, if logically prosecuted, must eventually include them. I cannot see one point in favor of the new system. It certainly weakens the permanence of nomenclature, for there is less reason to suppose that the mono-binomial is permanent than that the most recent binomial is. After fifty years or so of this upheaval we would be practically just where we are now, except that we should have added cumbersome formulas to nearly all our names. The new mongrel binomials would be subjected to just the same chances as those we now employ. We would have digged a hole for the extreme satisfaction of filling it up again.

The straits into which this new system often leads one are ludicrous. But I object to the untruthfulness of it, in many cases. Carex affords many examples. Tuckerman in 1843 designated a plant, which he took to be a form of *Carex scoparia,* as var. *moniliformis,* and another one thought to belong to *C. straminea* as var. *moniliformis.* Subsequently, Olney determinined that the latter is a distinct species and called it *Carex silicea.* Shall we now overturn the oldest specific name (silicea)— as is done in the Catalogue of Plants of New Jersey — and make an old varietal name a specific one? Shall we make Tuckerman say that he was mistaken and compel him, even indirectly, to raise his variety into a species? *Carex moniliformis* is not Tuckerman's. It is Britton's, and dates from 1889. Olney's name dates from 1868, and I see no other way than to make Britton's name a synonym of Olney's, as we have always done with recent names for all species. And if the var. *moniliformis* of *C. scoparia* should be erected into a species—what then?

They tell me that if botanists had always followed the methods of zoologists, using the oldest specific name in whatever genus, we should have been all right now. But as we did not start in this way, I do not see the force of the statement.

One of the most mischievous features of the whole thing is the ease with which authors of local floras obtain a cheap notoriety by making new combinations—which will likely be changed by the next cataloguer — and the extent to which it fosters the notion that making a new name and differing from an authority are the chief ends of systematic botany.—L. H. BAILEY, *Cornell University.*

NOTES AND NEWS.

DR. RICHARD SCHOMBURGK, director of the Botanic Gardens at Adelade, South Australia, died March 24, aged 80 years.

CORRECTION.— The name of J. N. ROSE should be inserted as joint author with J. M. Coulter of the new species, *Coursetia axillaris*, published last month, p. 180.

VON KLINGGRAEFF has observed Drosera Anglica in west Prussia catching butterflies—Papilio Daplidice and P. Rapae—through the coöperation of several leaves.

DR. GEORGE MACLOSKIE, of Princeton college, has charge of the biological work at "The Seaside Assembly," at Avon-by-the-sea, N. J., during this summer. The work extends from July 5th to August 28th.

AN EXPEDITION has been organized to study Mt. Orizaba, Mexico, during the present summer. Mr. Henry E. Seaton will act as botanist and make a study of the flora in relation to altitude and other conditions.

PROFESSOR JOHN M. COULTER will spend much of the summer along the Mexican border studying the *Cactaceæ*. The work is under the direction of the Department of Agriculture. Messrs. Walter H. Evans and G. C. Nealley will act as assistants.

REV. F. D. KELSEY, of Helena, Montana, has been endeavoring to stir up the spirit of botany in his state by delivering courses of lectures in the different colleges. During the last year he has delivered these courses at Wesleyan College, Helena, and College of Montana, at Deer Lodge.

WITH THE beginning of the second volume, *Zoe*, the biological journal of the Pacific coast, becomes a quarterly, and several biologists are associated with Mr. Brandegee as editors. We fear that the publication of the numbers at so long intervals will be disadvantageous. The April number has a lithograph portrait of Dr. H. W. Harkness as a frontispiece.

A DIRECTORY of European botanists has just been issued by Wilhelm Engelmann, of Leipzig, under the title *Botanisches Adressbuch*, which will be of much service to correspondents. A new edition of Cassino's International Scientists' Directory is being prepared, and will be issued early the coming year. Such works are of value in proportion to their completeness and accuracy, and every person owes it to his fellow workers to see that his own address is properly inserted.

ERRATA.—The following corrections should be made in Mr. Hitchcock's article on West Indian plants. Page 137, line 3 from bottom and p. 138, line 3, for sap read *sop;* line 20, for savory, *curry;* fotnote 24, for Rollinia Sieberi, *Anona squamosa;* footnote 26, for Anona squamosa, *A. muricata;* p. 138, line 12, for mashed, *washed;* line 4 from bottom, for ocara, *ochra;* footnote 42, for Abelmoschus moschatus, *A. esculentus;* footnote 41, for Lechium, *Sechium;* p. 140, line 2, for pie, *pea;* line 5, for roots, *nuts;* line 15, for Lucca, *Lucea.*

A NEW journal devoted to plant diseases, entitled *Zeitschrift für Pflanzenkrankheiten* has made its appearance under the editorship of Dr. Paul Sorauer, and with the assistance of many able investigators, including Prof. Farlow, Prof. Humphrey and Mr. Galloway, of this country. The price is M. 15 ($3.75) a year. The editor is the author of the largest and best treatise on plant diseases yet published, and the foremost investigator in this line of study. The journal will undoubtedly prove specially acceptable and serviceable to a large circle of investigators.

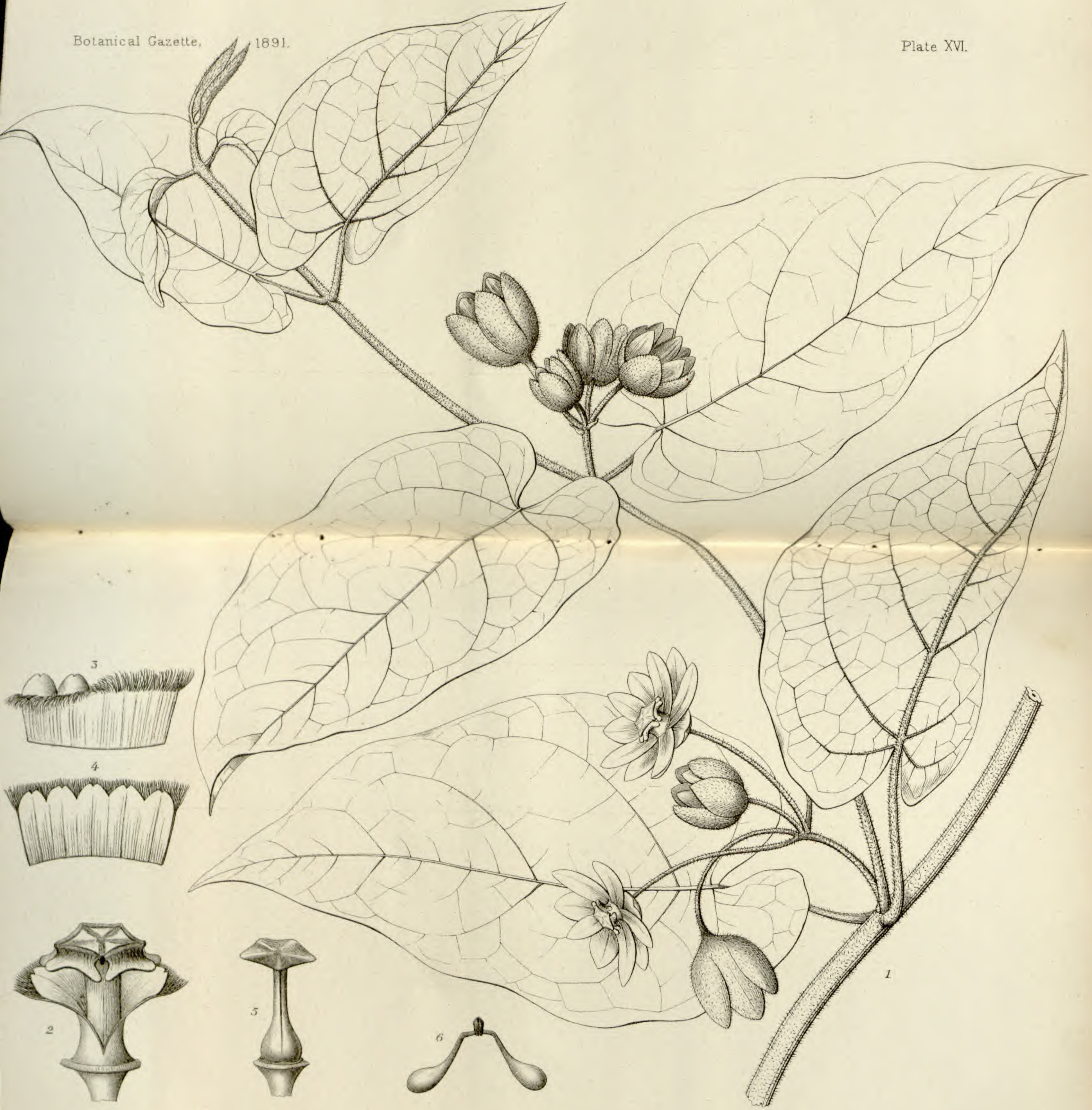
THE CALIFORNIA Botanical Club was organized March 7th. In response to a call from Dr. H. W. Harkness and others a meeting was held in the herbarium room of the California Academy of Science at which the objects of the proposed club were set forth. May 2nd the charter roll of members was declared closed with 99 names. The list includes a considerable number of the more prominent botanists about San Francisco, but a few names are conspicuous by their absence. The club is to meet on the first and third Saturdays of each month at the rooms of the California Academy.

MISS ROSINE MASSON died in Lausanne, May 6th, aged 83 years. The deceased had attained a wide reputation in Europe and was known in this country by her extensive collections and distributing of alpine plants, principally collected by herself even to her very last days. The specimens distributed by her showed great care in preparation and identification. Besides rendering valuable contributions to the knowledge of the flora of Switzerland, she deserves much credit for the assistance she has given to the study of botany by her magnificent collections, deposited in several of the most prominent scientific institutions.—T. H.

A SHORT communication in the *Centralblatt für Bakteriologie* (ix, 557) gives the comparative results arrived at by Dr. George Canera in studying the various forms of swine epidemic, known under the names of hog-cholera, swine-plague, swine-pest, etc. The germs were obtained from about a dozen of the most prominent investigators, and were uniformly grown upon and in various media, and their behavior carefully compared. The germs were found to belong to several different species, and to fall into three well marked classes, dependent upon their movement and other characters. Billings' swine-plague and Salmon's hog-cholera germs are said to be specifically different.

ANOTHER revolution has taken place in the matter of postage on botanical specimens. The act of Congress, approved July 24, 1888, fixed the postage on "seeds, cuttings, roots, scions and plants . . at the rate of one cent for each two ounces or fraction thereof." But the May Postal Guide contains a ruling by the Third Assistant Postmaster-General by which *dried* plants and *cut flowers* are specifically excluded from the provisions of this act and declared subject to the cent per ounce rate! By what legerdemain of logic this conclusion was reached the official document fails to state; but until more common sense or a specific act of Congress supervenes botanists will have to double the postage on their packages.

Botanical Gazette, 1891. Plate XVI.



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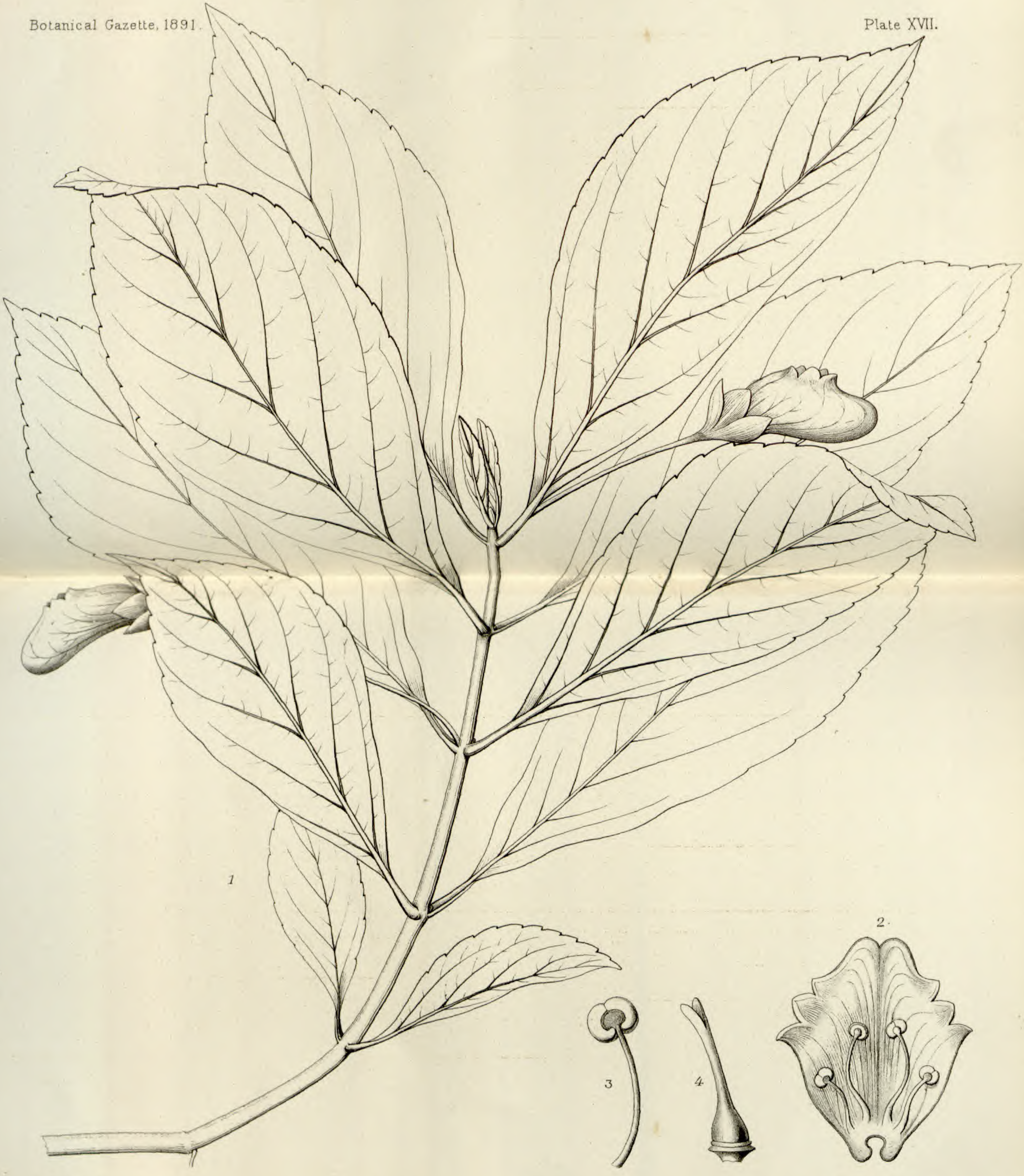
FIMBRISTEMMA CALYCOSA, n. sp.



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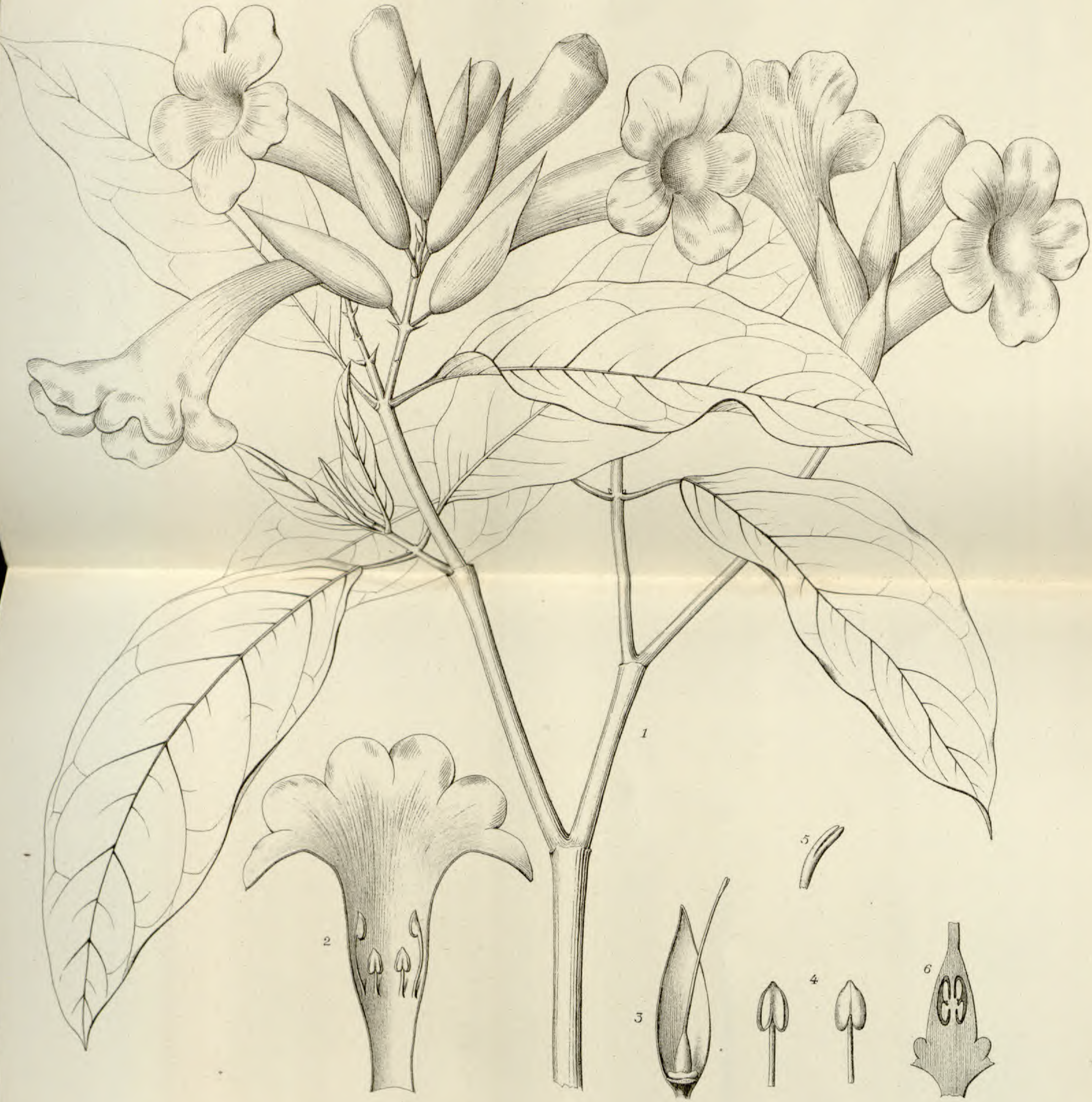

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MACFADYENA SIMPLICIFOLIA, n. sp.

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THAXTER on HYPHOMYCETES.

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VOL. XVI. AUGUST, 1891. NO. 8.

THE BOTANICAL GAZETTE

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[ISSUED AUGUST 15.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

Address C. R. BARNES at Cambridge, Mass., until Sept. 1.

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A study of some anatomical characters of North American Gramineæ. II.

THEO. HOLM.

The genus Uniola.

(WITH PLATES XXI AND XXII.)

Uniola gracilis Michx., *U. nitida* Baldw., *U. paniculata* L. and *U. Palmeri* Vasey.—These four species form together two groups, the first two on the one and the last two on the other side, on account of differences in the anatomical structure of their leaves. It was also to be supposed so, since they inhabit localities so very different. The first group occurs in the woods or swamps, while the second one grows on the sand hills on the sea shore. We shall now see how they differ from each other and from the species described in the preceding part of this paper, U. latifolia, an inhabitant of shaded slopes.

Epidermis.—The epidermis in U. gracilis and U. nitida agrees in most respects with that of U. latifolia, and the only essential difference consists in the presence or absence of long hairs and thorn-shaped expansions; U. gracilis shows the presence of both organs on the superior face of the blade, but in smaller number than observed in U. latifolia. In U. nitida these organs are entirely wanting.

The cells of epidermis which cover the stereome on the inferior face are strongly thickened and laminated in U. gracilis and U. nitida (plate XXII, fig. 6), which shows a difference from what we have seen in U. latifolia. The bulliform cells and the stomates show, however, nearly the same structure and distribution. But in U. paniculata and U. Palmeri the epidermis is entirely different; the cells on both faces are strongly thick-walled and porose (plate XXII, fig. 10), rectangular or quadrangular, and arranged so that there is either one short cell between two long ones, as in U. Palmeri, or even three short between two long ones, as has been observed in U. paniculata.

No hairs are present in these two species, but numerous sharply pointed and porose spines (plate XXII, figs. 11–12) proceed from the superior face of the leaf of U. paniculata, while in U. Palmeri the epidermal expansions are merely represented by wart-shaped, obtuse organs. The epidermis of the inferior face is on the contrary entirely smooth in these two species.

Stomates are present on both faces, but especially on the margins of the deep sinuses of the superior face, in the strata which border on the bulliform cells ; these stomates show in U. paniculata the normal aspect, but in U. Palmeri they are slightly depressed below the general surface (plate XXII, fig. 14), and surmounted by wart-shaped expansions from the epidermis in groups of as many as seven. The bulliform cells of U. gracilis and U. nitida agree very well with those described for U. latifolia; in U. paniculata and U. Palmeri they form only very small groups, but are here in contact with a large mass of uncolored parenchyma.

Mestome-bundles.—The arrangement of these is easily to be seen, if the sections figured in the accompanying plates are examined. Plate XXI, fig. 1 shows a section of the median part of the blade of U. gracilis; plate XXII, fig. 7, a similar section of U. nitida; fig. 8 of U. paniculata; and fig. 13 of the female plant of U. Palmeri. It must be remarked here that the anatomical structure of the leaf of the male and female plant of U. Palmeri is identical.

The carene in U. gracilis and U. nitida is occupied with but a single mestome-bundle, whereas there were several in U. latifolia. In U. paniculata and U. Palmeri there is no carene and the median nerve is not different in any respect from the largest ones in the whole blade. Furthermore there are no mestome-bundles between the groups of bulliform cells and the epidermis of the inferior face, as was the case in U. latifolia.

The minute structure of the mestome-bundles in U. gracilis and U. nitida is the same. There is a thin-walled parenchyma-sheath around the entire bundle, uncolored in the midrib or partly green in the other ribs. Sometimes, as for instance in the large bundles excepting the median one, the parenchyma-sheath has a few thick-walled cells, where it is in contact with the stereome. But besides this, the proper sheath is also to be seen and inside this another one, which consists of very thick-walled cells, forming in the largest bundles, those of first degree, a closed sheath around the leptome and the hadrome. This inner sheath is also present in the smaller bundles, but is here more or less interrupted (plate XXI, fig. 4). In U. latifolia there is present a thick-walled parenchymatic tissue between the leptome and hadrome, and the same is also to be observed in U. gracilis and U. nitida, at least in the largest bundles. But neither this stratum nor the inner sheath of thick-walled cells may be considered as indicating any mestome-sheath ; they merely represent a mestome-parenchyma for the same reason as mentioned for U. latifolia.

The mestome-bundles show, as in U. latifolia, three different forms depending on their strength and development. Those of the first degree have a closed inner sheath besides a layer of similar thick-walled cells between the leptome and hadrome, while in those of the second degree the leptome and hadrome are in contact with each other. In the smallest bundles there is no closed inner sheath of thick-walled cells, but merely an interrupted layer on the leptome side, and the leptome and hadrome are in immediate contact with each other. The leptome and hadrome, considered by themselves, show the strongest development in the largest bundles, those of the first degree.

As to the distribution of these different forms of mestome-bundles in the entire blade, I do not dare try to give any formula, as has been done in U. latifolia. There seem to be too many variations, especially on comparing leaves of specimens from different localities, but it may be said with good reason that the bundles of the second degree are the most numerous in the whole blade, while the largest ones are present in a relatively small number.

On examining the mestome-bundles in U. paniculata and U. Palmeri, there will be seen a rather important difference in structure from what has been shown above. The proper parenchyma-sheath is thin-walled in both species, but contains large deposits of starch in U. paniculata (plate XXII, fig. 9) and forms a border between the entire mestome-bundle and the mesophyll on both sides. In U. Palmeri (plate XXII, fig. 5) on the contrary it does not contain starch and forms an annular sheath around the whole bundle, not extending to the epidermis on either of the two faces.

There is in the largest bundles of U. paniculata a closed sheath of thick-walled parenchyma around the leptome, while in U. Palmeri both the leptome and hadrome are surrounded by a similar sheath, besides which the leptome contains several groups, more or less isolated, of very thick-walled cells.

Although not strictly belonging to the mestome-bundles, it may be mentioned here, that there is in the U. paniculata a quite considerable tissue of large-celled parenchyma between the hadrome and the stereome of the superior face, and this parenchyma contains starch, like the surrounding sheath.

We shall also find in these two species a certain difference as to the development of the mestome-bundles, as described for the preceding species. U. paniculata shows two degrees, the first one as described above; the second is on the contrary characterized by having the leptome and hadrome in contact with each other. U. Palmeri shows, besides the form of the first degree described above, a second one, in which the inner sheath is reduced to a horse-shoe shaped layer on the leptome side, besides a few thick-walled cells between the leptome and hadrome but none in the leptome itself.

These layers of thick-walled cells in the mestome-bundles of U. paniculata and U. Palmeri, whether they form a closed sheath or not, are identical with those mentioned for the preceding three species, as representing a mestome-parenchyma; the same is the case with the groups of similar cells, which we have seen in the leptome of U. Palmeri. Concerning the distribution of these different mestome-bundles in the U. paniculata and U. Palmeri, those of the second degree are the most numerous, but no rule can be given as to their situation between the larger ones.

The stereome.—This forms in U. gracilis and U. nitida two groups, one above and one below each mestome-bundle, and shows only very small differences. In U. gracilis the stereome of the superior face of the carene is widely separated from the mestome-bundle by a large tissue of uncolored parenchyma, while in U. nitida it borders immediately on the parenchyma-sheath. It forms as in U. latifolia a nearly triangular group on each margin of the blade. Nearly the same arrangement is found in U. paniculata, in which there is one group above and below each mestome-bundle. In this the stereome of the superior face is widely separated from the mestome-bundle by the parenchyma, which has been described above. Small groups of stereome are also to be observed inside the proper parenchyma-sheath of this species (plate XXII, fig. 9); it seems as if these thick-walled cells belong to this element, the stereome, rather than to the hadrome.

Finally U. paniculata shows groups of stereome opposite the bulliform cells, separated from these by an uncolored tissue of parenchyma. U. Palmeri has not these last mentioned stereome-groups opposite the bulliform cells, but merely one above and one below each mestome-bundle, both of them bordering on the parenchyma-sheath.

Besides these groups of stereome, there is also one large group on each of the two margins of the blade of both U. paniculata and U. Palmeri.

The mesophyll.—This tissue is most extensive in U. gracilis and U. nitida, where it forms broad layers of rather large cells between the mestome-bundles and is in contact with epidermis on both faces. It is relatively but sparingly represented in the two other species, and is here not only separated by the mestome-bundles with their corresponding groups of stereome, but also by the broad layers of uncolored parenchyma. Thus there is one two isolated group of mesophyll on each side of the mestome-bundles. The cells of this tissue are, in U. paniculata and U. Palmeri, rectangular, very narrow and thin-walled.

The uncolored parenchyma.—This is very distinct in the carene of U. gracilis (plate XXI, fig. 2), where it occupies a large space between the mestome-bundle and the superior epidermis. There is also in this same species a single stratum of uncolored cells outside the parenchyma-sheath of the two mestome-bundles next to the midrib and bordering on the carene (plate XXI, fig. 1). This parenchyma is also present and relatively much more abundant in U. paniculata and U. Palmeri, where it forms large groups between the bulliform cells and the epidermis of the inferior face.

From the foregoing it will be seen that these five species of the genus Uniola show several anatomical characters in their leaf-structure by which they may easily be distinguished. These characters may be summarized as follows:

Epidermis.

Large cells in alternation with small ones	U. paniculata. U. Palmeri.
Long hairs on the superior face	U. latifolia. U. gracilis.
Thorn-shaped expansions on the superior face	U. latifolia. U. gracilis. U. paniculata.
Wart-shaped expansions on the superior face	U. Palmeri.
Bulliform cells forming large groups	U. latifolia. U. gracilis. U. nitida.

Bulliform cells forming smaller groups	U. paniculata. U. Palmeri.
Stomates depressed, surmounted by epidermal expansions	U. Palmeri.

Mestome-bundles.

One buudle between each group of bulliform cells and the inferior epidermis	U. latifolia.
Leptome and hadrome surrounded by a sheath of thick-walled parenchyma in the large bundles	U. gracilis. U. nitida. U. Palmeri.
Only the leptome surrounded by thick-walled cells	U. latifolia. U. paniculata.
Groups of thick-walled parenchyma in the leptome	U. Palmeri.
Parenchyma-sheath containing starch, extending from the superior to the inferior epidermis, not forming any annular sheath around the bundle	U. paniculata.

Mesophyll.

Separated by groups of uncolored parenchyma	U. paniculata. U. Palmeri.

Stereome.

Six isolated groups on the superior face of the carene	U. latifolia.
One group opposite the bulliform cells	U. paniculata.
Isolated groups inside the parenchyma-sheath	U. paniculata.

Uncolored parenchyma.

One large group in the carene	U. latifolia. U. gracilis.
One group between the mestome bundles	U. paniculata. U. Palmeri.

U. S. National Museum, Washington, D. C.

EXPLANATION OF PLATES.

PLATE XXI.—Figs. 1-4. *Uniola gracilis.*—Fig. 1. Transverse section of leaf. × 37.—Fig. 2. Transverse section of the median part of the leaf, the carene; the inferior face of the leaf at *I.* × 160.—Figs. 3 and 4. Transverse sections of two small mestome-bundles. Fig. 3 shows a closed sheath of thick-walled parenchyma-cells inside the proper parenchyma-sheath *P. L*, the leptome: *S*, the stereome on the inferior face of the leaf. In fig. 4 the inner sheath is not complete, but merely represented by two groups of thick-walled cells. × 200.

Fig. 5. *U. Palmeri.* Transverse section of a large mestome-bundle. On the left side in the figure are the bulliform cells to be seen at *B*, *C*, and the mesophyll at *M.* Several thick-walled parenchyma cells are to be observed in the leptome and there is a closed sheath of similar cells inside the proper parenchyma-sheath *P.* × 320.

PLATE XXII.—Fig. 6. *U. gracilis.* Epidermis, taken from the carene, transverse section. × 560.

Fig. 7. *U. nitida.* Transverse section of leaf; the inferior face at *I.* × 74.

Figs. 8-12. *U. paniculata.*—Fig. 8. Transverse section of leaf; the inferior face at *I.* × 60. Fig. 9. Transverse section of a large mestome-bundle. The proper parenchyma-sheath, *P*, contains starch, figured in a few of the cells, as does also the large parenchyma cells between the mestome and the stereome of the superior face. The leptome is enclosed by layers of very narrow cells and separated from the hadrome. × 240. Fig. 10. Epidermis of the inferior face. × 560. Figs. 11 and 12. Thorn-shaped expansions from the superior epidermis, seen from the side and from above. × 240.

Figs. 13 and 14. *U. Palmeri.*—Fig. 13. Transverse section of leaf. × 74. Fig. 14. Stomate from the inferior face, transverse section. × 320.

Notes on Uredineæ.

J. C. ARTHUR.

Puccinia Stipæ is variously cited by different writers. Dietel[1] writes *P. Stipæ* Opiz, and considers the American form, heretofore called *P. Stipæ* Arthur, identical with it. In Sydow's Uredineen, fascicle I, No. 28, it is given as *P. Stipæ* (Opiz) Hora, and is so spoken of by Magnus[2] in a notice of the publication.

Opiz[3] made use of the name in a list of Bohemian plants, in which no characterizations or notes of any kind are given. It was not used as a specific name, but for a sub-form of a variety of P. Graminis. The full name reads *Puccinia Graminis* Pers., c *foliorum* Opiz, *β Stipæ* Opiz.. The host is not mentioned, but it was presumably a Stipa, and quite possibly S. capillata, on which the rust was gathered in 1888 by Paul Hora in the region covered by Opiz's list. Whether a description of the species has been published by Hora or not the writer does not know, but if so it probably did not antedate the publication in America.[4] The name correctly written would therefore be *Puccinia Stipæ* (Opiz) Arthur.

Puccinia ornata was first published as the name of a Leptopuccinia on Rumex[5] in 1887, and consequently the later application of the specific name to another Puccinia by Harkness[6] calls for correction. It would be a pleasure to dedicate this interesting form to the discoverer, if another species of the genus did not already bear his name. The name **Puccinia medusæoides** is therefore proposed for it, from the resemblance of the branched pedicel of the teleutospores to that of Spegazzini's *P. Medusa.*

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[1] Hedwigia, xxviii, (1889, p. 187).

[2] Hedwigia, xxviii, (1889, p. 94).

[3] Seznam Rostlin Kvetêny Ceské, 1852, p. 138.

[4] Arthur, Preliminary List of Iowa Uredineæ, in Bull. Iowa Agric. Coll., Nov. 1884, p. 160.

[5] Report of botanical work in Minnesota, in Bull. No. 3, Geol. Surv. Minn., 1887, p. 30.

[6] Proc. Cal. Acad. Sci., 2nd. Ser., ii. 1889.

Uromyces perigynius has an error in the description as originally published in Journal of Mycology, v. p. 11, to which my attention has been directed by Mr. E. W. D. Holway. The measurements of the teleutospores, as there given, should be multiplied by three, making the true dimensions $12–18 \times 24–30\mu$.

The teleutospores found upon the leaves do not, as a rule, have the apex long and pointed, but more or less rounded, and the spore correspondingly shorter.

Dietel[7] demonstrated that *Uromyces Caricis* Peck, is the uredo of a Puccinia, which he called *P. Caricis-strictæ* D., and remarked that no true Uromyces upon Carex is known. A month afterward *U. perigynius* Halst. was published, and it appears to be a true Uromyces. No mention in the original description is made of the uredo form, but I have received from Mr. E. W. D. Holway excellent material collected in August, 1887, upon the leaves of *Carex pubescens*, bearing both uredo- and teleutosori. The uredospores are globose, epispore thin and echinulate, $15–18\mu$ in diameter, with occasionally a spore measuring $22–28\mu$. The uredospores possess two or three lateral germ-pores, while the teleutospores have a single terminal germ-pore. This pore is not easily demonstrated in most cases, even with the use of sulphuric acid. Any doubt of its presence, however, is put to rest by a specimen collected by the writer, in Indiana, upon a Carex that is probably C. pubescens. It was found in May upon the leaves of the preceding season's growth. Most of the teleutospores in this specimen have the terminal pore distinctly open, from having already germinated without dropping out of the sorus.

Coleosporium Viburni was established upon the uredo form alone. Teleutospores have since been gathered upon the same host, *V. Lentago*, at Racine, Wis., by J. J. Davis. The sori are hypophyllous, scattered, yellow; teleutospores cylindrical, or elongated clavate, three- or four-locular, smooth, $20–30 \times 65–90\mu$.

Puccinia Cyperi n. sp.—Sori irregularly scattered upon effused brown spots on the culms and under surface of foliage and involucral leaves, oblong, long covered with thick epidermis; uredospores elliptical or nearly round to obovate, epispore thin, echinulate, 19–22 × 20–30μ; teleutospores brown above and pale below, elongated oblong, little if any constricted, vertex strongly thickened, obtusely and obliquely pointed, epispore thin, smooth, 17–20 × 33 × 63μ; pedicel short, one-third the length of the spore or less, slightly colored.

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[7] Hedwigia, xxviii (1889), p. 22.

On *Cyperus Schweinitzii:* Iowa, E. W. D. Holway, J. C. Arthur; Nebraska, H. J. Webber, in *Flora of Nebraska*, No. 369; Wisconsin, W. Trelease and L. H. Pammel, in *Paras. Fungi of Wis.*, No. 202. On *Cyperus strigosus:* Michigan, J. C. Arthur.

This species is related to *P. obtecta*, and in the form of its teleutospores also resembles *P. Caricis*, to which it has been referred.

Uromyces Gentianæ n. sp.—Sori scattered over the green parts of the host, oblong or round, soon naked, brownish-yellow color; uredospores globose or ovoid, epispore thin, echinulate, 18–20 × 19–25μ; teleutospores globose or ovoid, yellowish-brown, vertex rounded, slightly thickened, epispore thin, obscurely papillate, 15–19 × 19–23μ, pedicel fragile, very short.

On *Gentiana quinquefolia* var. *occidentalis*, Decorah, Iowa, E. W. D. Holway.

The teleutospores are almost the same size and color as the uredospores, and quite different from the one-celled teleutospores of *Puccinia Gentianæ*. That these are genuine teleutospores is certain from the presence of a terminal pore, which shows very distinctly upon using sulphuric acid. Their close resemblance to the uredospore has caused them to be overlooked heretofore. The uredospores are sometimes thickened like the teleutospores, but the spot is always lateral, and not terminal, and by using acid the two or three lateral pores can be made visible.

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A sketch of the flora of Orono, Me.

F. LAMSON-SCRIBNER.

[The writer desires to have the facts embodied in the following paper, prepared in 1872 and hitherto unpublished, placed on record for the use of those who may hereafter compile the flora of Maine.]

An account of the flora of any region is valuable as indicating the local distribution of plants—a matter of much interest to the botanist and agriculturist. The geographical range of species is thus established. A knowledge of the plants of a locality enables one to form a very correct opinion of its climate and the nature and condition of the soil. On the other hand, the climate and physical features of a locality form an index to the variety and nature of the plants which may there be found. The extreme northeastern position of this locality renders it of more than ordinary interest.

The physical characters of this region are such as to afford a large number of species, and I very much regret that the list here presented is a so meager. It is to be hoped that the work thus begun will be rapidly advanced by the students of the College, in order that we may soon possess a complete list of the Phanerogams and Vascular Cryptogams of this entire region. The Mosses and Lichens have not yet been worked up. Of these lower, yet vastly interesting families this section certainly presents a rich field. Future researches will not only add much to our knowledge of those species already observed, but largely increase the list now made.

Almost every variety and condition of soil found in our latitude—except that of the seashore and high mountains—is to be met with here. The Stillwater branch of the Penobscot river flows close by the College front, and a mile in the opposite direction flow the rapid waters of the main river. Species delighting in sandy and rocky river banks find along these waters congenial homes. There are extensive meadows and upland glades; numerous streams of varied character; deep sphagnous and grassy swamps of larch, spruce and cedar. There are high rocky deciduous woods; steep gravelly hills and sandy fields; several ponds or lakes with both sandy and muddy shores, and an almost unlimited extent of mossy bog-land.

With all these varied conditions one may reasonably expect an extensive and interesting flora. Only a small portion of this territory has been thoroughly examined, and no one locality visited throughout the entire season. The blooms of the month of August have been but partially observed, that being the month of the summer vacation. It has been my good fortune to examine the floras of Manchester and Waterville of this State; as compared with these the region of Orono and vicinity is much more interesting botanically, being peculiarly rich in rare and local species. Several localities, visited but once or twice, have appeared very interesting, and may, when more thoroughly explored, yield many rare and pleasing species.

Such a locality is the one near Pushaw mills, on the river about two miles above Stillwater village. This place was visited in June, last season, and we were rewarded by finding several species new to our list, one of rare interest. The water at this place rushes rapidly over a rocky bed, and the west bank is formed by a high precipitous cliff, on which specimens of the Sand Cherry (Prunus pumila L.) were found. This, our smallest species of the cherry tribe, is a little trailing shrub growing over the sand and rocks, rarely attaining the height of sixteen inches. Growing in abundance close by the bank were Aquilegia Canadensis L., Potentilla tridentata Ait., and the small purple Houstonia (H. purpurea L., var. longifolia Willd.). Out from the perpendicular walls of the cliff there was growing a pretty little fern, which was too immature for identification. But the chief interest of this locality is that it produces Arabis Drummondii Gray, the upright slender stems standing out from the bare rock walls, wherever there is a possibility for its fibrous roots to penetrate and find foot-hold. This is a rare, and, on account of its pale glaucous leaves and rose white flowers, a very attractive Crucifer. Although uncommon, this species has a wide geographical range, extending from Maine to Oregon. Astragalus alpinus L., an exceedingly pretty leguminous plant which grows on a small rocky island in the Kennebec river opposite Waterville, may be looked for here. Coming back to the College from the place we have just been describing I found numerous specimens of Carex Houghtonii Torr., growing on the grading of the Orono and Stillwater Railroad near the town bridge at the last named place. The Rev. J. Blake has collected this Carex at Medford. Another locality which has been visited but once (July 1870) is Nickol's Stream which flows through an extensive bog and forms the outlet of a pond of the same name in the town of Bradley.

The plants which characterize the place, as observed upon one hasty trip, are Lycopodium inundatum L., Eriophorum alpinum L., Limnanthemum lacunosum Griseb., Carex rostrata Mx., and Spartina cynosuroides Willd. This last species was found just by the outlet of the pond. The Lycopodium is a dwarf species from one to three inches high. It was growing on muddy soil close by the waters of the stream. Last season I found the same species growing on a bog in Manchester. It is quite rare, and valuable for exchanges. The enthusiastic student would be well repaid by a visit to this stream.

An excursion was made to Pushaw Lake in June, 1870, and the following species noted: Lobelia Dortmanna L., Nuphar luteum Smith, var. pumilum, Pontederia cordata L., Brasenia peltata Pursh., Eriocaulon septangulare With. Near the lake, Potentilla palustris Scop. was found in abundance. Along the way to the lake specimens of Smilacina trifolia Desf. and Phalaris arundinacea were collected.

About three miles southwest from Orono village there is a large bog, where are found nearly all the plants common to such localities. The main road from Stillwater to Bangor passes through this, making it easy of access. From here most of the bog plants of the College herbarium were obtained. The last of April or early in May we go to this locality for Symplocarpus fœtidus Salisb., Cassandra calyculata Don, and Andromeda polifolia L. It is here too that we find the Lonicera cœrulea L. and later in the season Arethusa bulbosa L., Calopogon pulchellus R. Br., Pogonia ophioglossoides Nutt. and Habenaria blephariglottis Lindl., four of our prettiest Orchids. The Pitcher Plant (Sarracenia) luxuriates here in the damp Sphagnum, opening its odd flowers with deep purple, fiddle-shaped petals and umbrella-like style, about the middle of June. Among the species of this bog we mention the species of Osmunda and Eriophorum, Menyanthes trifoliata L., Carex pauciflora Lghft., C. chordorhiza Ehrh., C. lacustris Willd., and many other species of Cyperaceæ.

In the woods which lie in a direct line from the College to the bog here spoken of, known as Bennock's woods, there were collected last summer (1873) many specimens of Calypso borealis Salisb., a rare and most beautiful Orchid. In one small spot, not more than 2 feet square, the writer observed nearly one hundred specimens in full bloom! A more pleasing or beautiful sight can hardly be imagined. A few specimens of the Calypso have been found in the swamp east of the Colleges. It has also been seen in considerable numbers in the woods opposite the "Trotting Park." In Bennock's woods above mentioned, I gathered in 1871 a number of specimens of Botrychium simplex Hitch. In 1870 this plant was observed in the low fields between the house formerly occupied by Prof. Peckham, and the river.

An exceedingly rich and interesting locality, botanically considered, is the region below Basin Mills, extending down by the river and along the railroad for two or three miles. Here we find a great variety in the nature and condition of the soil, producing many species. Upon a high and gravelly bank less than half a mile below the Basin, near John McPheter's brook, grows a rare and elegant vine, Clematis verticillaris DC. It is a more delicate plant and prefers a drier soil than its near relative, C. Virginiana L. It is by far the prettier species, however; in fact it well deserves to stand first, as regards ornament, among our native climbers. The showy bluish purple petals of the flower expand two or three inches. It blooms from the middle to the last of May. The flowers are followed by the rather pretty plumose fruit. It is easily cultivated and is worthy a place among our handsomest foreign vines. By the rocky bank of a railroad cut, perhaps two miles below the mills, we find another beautiful native climber, called Wax-work or Bittersweet, Celastrus scandens. It receives its first name on account of the waxy aspect of the fruit, which in autumn presents a most brilliant appearance. Near where the Bittersweet grows there is found an abundance of the bright Saxifraga Virginiensis. Along by the railroad we find the pretty Corydalis glauca. Near the railroad there is a bog-marsh where delights the Calla palustris. Upon the bog we find Carex irrigua, one of the most attractive of the Carices.

About a mile below the mills there is a slow muddy stream where grows Nuphar advena. In a thicket close by this stream we find rather an uncommon species of Trillium (T. recurvum), which conceals its white or sometimes pinkish flower beneath its trio of leaves. Upon the dry banks near by Pedicularis Canadensis abounds, with its long, finely cut leaves, which are often of a deep purple color, and very handsome. Two miles, or perhaps two and a half miles below the mills, there is a rich marshy spot where in May we are attracted by the bright golden flowers of Caltha palustris. This is also the locality of Thaspium aureum and Archangelica atropurpurea. On the shaded banks near at hand grow the large yellow Viola pubescens and Thalictrum dioicum L. Just below the mills in early spring may be observed the large coarse plaited leaves of Veratrum viride Ait. This locality also contains Nemopanthes Canadensis, Cassandra calyculata, Rhodora Canadensis, Ledum latifolium, Kalmia glauca and K. latifolia.

On the island at Basin Mills Arctostaphylos Uva-ursi Spreng., Houstonia purpurea, var. longifolia Gray, and Oryzopsis Canadensis may be found. Veronica Buxbaumii Tenore was collected on the high bank between Orono village and Basin Mills, just above "Cold Spring."

In a swamp in Bradley on the left hand side of the road going to Nickol's Stream, grows the most showy and beautiful of the Lady's Slippers, Cypripedium spectabile. With this Cypripedium are found Habenaria hyperborea and Listera cordata. The latter delicate and inconspicuous little orchid also abounds in the swamp just east of the College.

We now come to consider a few of the more interesting plants found immediately about the College. The Calypso has already been alluded to as having been observed near here. In the field in the rear of the new barn, specimens of Ophioglossum vulgatum were gathered in 1872. In the clearing in the same direction Nardosmia palmata grows in great abundance. I have observed this plant growing sparingly in Manchester. Dr. Goodale speaks of its being common in swamps near the Canada line on the "Canada Road." It is by no means a rare plant in this neighborhood. In some places it is as abundant as Erechthites on newly burnt land. This plant blooms the first of May, and is quite a puzzle for beginners, not only on account of its Composite character, but because the palmate leaves (whence the specific name) do not appear till late in the season.

Specimens of Aralia quinquefolia have been collected in the woods near the "Trotting Park." Vaccinium Canadensis Kalm abounds just east of the College. It is distinguished by its low growth and pubescent leaves, better known, however, by its rich, sweet berries. The following Orchids are found in the woods back of the College: Habenaria Hookeri Torr., H. orbiculata Torr., Spiranthes cernua Rich., S. gracilis Big., Corallorhiza innata R. Br., C. multiflora Nutt., Goodyera repens R. Br., G. pubescens, R. Br., Listera cordata R. Br., Calypso borealis Salisb., Cypripedium parviflorum Salisb. ' C. acaule Ait.

The kinds of trees composing these woods are hemlock, fir, spruce, poplar, pine, maple, birch, beech, etc. The woods about the College are thus of a mixed growth, coniferous trees and soft wood predominating. The forests west and north on rocky uplands have more hard wood species. The forests are all second growth and none of the trees are of large size. Hard woods suitable for lumbering purposes are very scarce. The same is true of pine. The sugar maple occurs, but not in sufficient abundance to make sugar-making a paying business.

Acer dasycarpum Ehrh. grows along the banks of the river between Stillwater and Orono villages. It is a tree of large growth and often maintains a majestic, if not a magnificent appearance. It is distinguished from A. rubrum L. by the silvery whiteness of the under surface of the leaves, whence the trivial name. The branches are large and gradually expanding as they ascend, often becoming recurved somewhat in the manner of the elm. The wood is soft and fine grained, of moderate strength and perishable.

By the river in front of the College we find Viola lanceolata and Ranunculus Flammula, var. reptans. Potentilla palustris and Campanula aparinoides are found in the meadow below the farm house. On the side of the river opposite from the farm house there grow two very attractive vines, Calystegia sepium and Apios tuberosa. During the past season there was found along this bank the noble Ostrich Fern (Struthiopteris Germanica Willd.).

The variety of grasses upon the farm are those of common occurrence though there is a greater predominance of the better sorts. The bits of swale land, which are few, contain the ordinary sedges and species of Glyceria. The chief grasses which form the hay crop are timothy and red top with occasional plants of brown top or fowl meadow grass. With this hay there is mixed a small proportion of several kinds of clover. The forage plants which have been introduced by the present farm Superintendent are Hungarian millet and Alsike clover.

There are but few weeds found in Maine which have not been observed growing upon the College premises. Last season there was detected in a grain field a weed which the writer at least had not before observed, viz.: Camelina sativa Crantz. Darlington says this plant was introduced with flax, and remains as weed where the culture of that plant has been abandoned. There is much danger of new weeds being introduced with the seeds or roots of plants received upon the farm from the Patent Office and elsewhere. Those weeds which give the most trouble are barn grass, rag-weed, purslane and couch or witch grass. The number of species in the College herbarium is 316, representing 66 orders. This does not include several species undetermined, nor the Compositæ, Salices, Juncaceæ, Cyperaceæ, and Gramineæ, and only a portion of the higher Cryptogams. The actual number of species observed, aside from the families mentioned, is 455.

Orono, Maine, 1872.

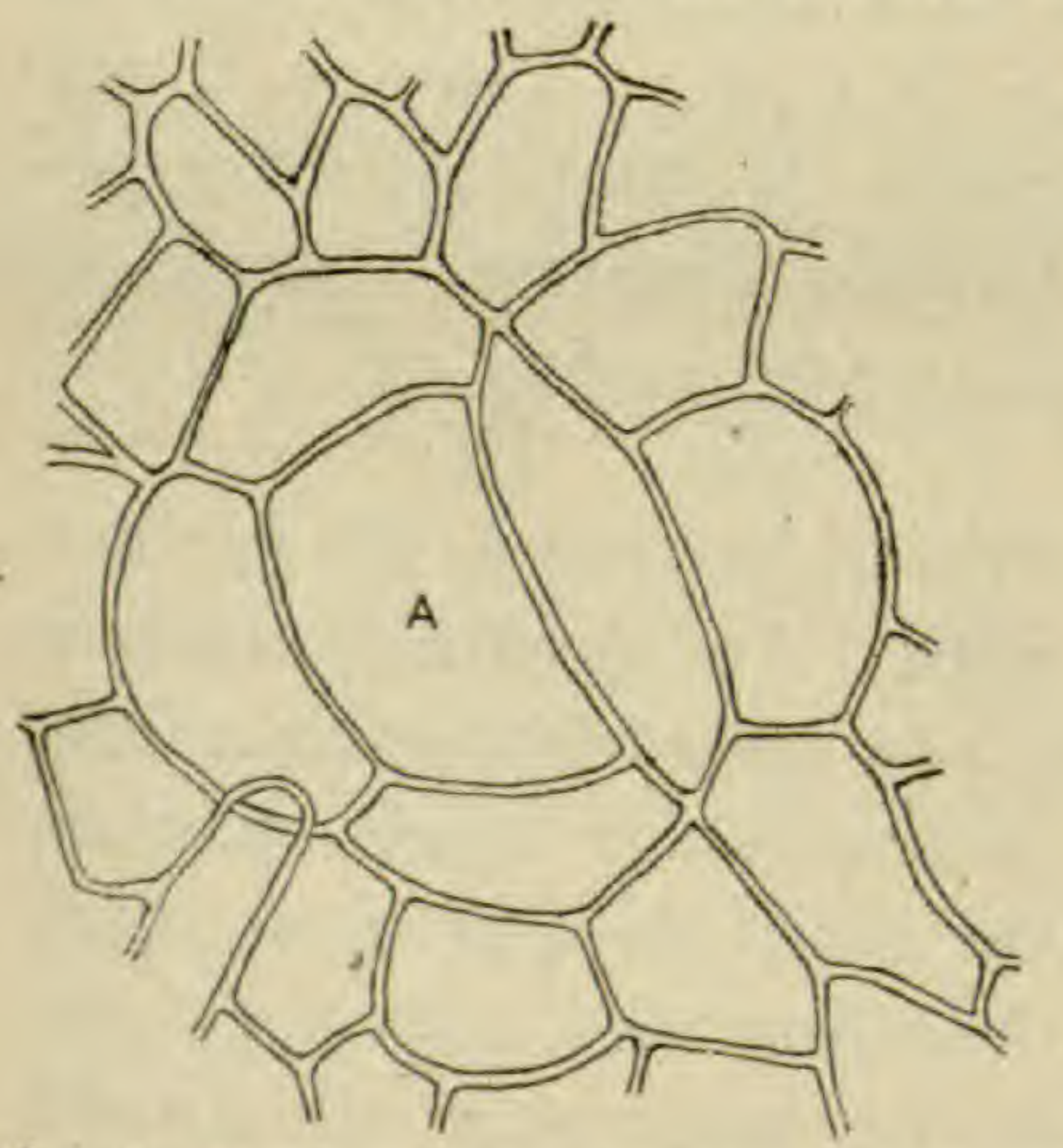
BRIEFER ARTICLES.

Notes on the pollination of Helianthus.—Having had growing in my room for some months a specimen of Helianthus annuus, I have observed its habits closely to see if I could find something new or interesting. Nothing out of the ordinary was observed until it came to bloom, which it did in March, bearing a single head. During this period I observed it very closely, from the time of the opening of the first disk floret until the last had withered away. Most of the flowers behaved in the usual way, the style pushing out the pollen from the stamen tubes and cross-fertilization was insured by protandry. But in a number I noticed movements, to me quite new and interesting.

The styles in these cases appeared as usual and soon spread their tips for the reception of pollen. After standing in this way for about two days I was greatly surprised to see that they were being drawn back into the stamen tube. This they continued to do until they finally disappeared. Then the stems were forced to one side and from between the filaments were seen the bent styles slowly backing out, resembling very much the extraction of the plumule from the acorn in germination. This it continued to do until the entire style was withdrawn, leaving the stamens wilted and collapsed lying upon the limb of the corolla. Then the style assumed an erect position, spread its tips and apparently stood waiting to receive pollen. This entire act was accomplished in about a dozen cases; failed to more than draw back into the stamen tube in about as many more; and in two the style was broken in attempting to escape. All this was observed only in the outer circle of tubular flowers, which preceded the others by about four days.

The reason for this I attribute to the attempt of the flowers to secure pollination. The plant was kept in a room, and while the flowers were few in number there was no chance for the transfer of pollen, as was easily the case when they became more numerous and crowded. The stamens appeared to wilt in about two days after their pollen had been thrust out by the styles and had they, as was observed in later cases, drawn the styles down into the tube with them, then the object of their living would have been defeated. In two cases I transferred pollen to the stigmas and no movement of the styles was noticed independent of the stamens, but after a time both styles and stamens were drawn down within the tube. My conclusion is that undoubtedly the first cases failed of fertilization and the withdrawing of the styles and the subsequent unfolding of the style branches was a plan to longer present their stigmas for the reception of pollen.—WALTER H. EVANS, *Herbarium Eli Lilly & Co., Indianapolis.*

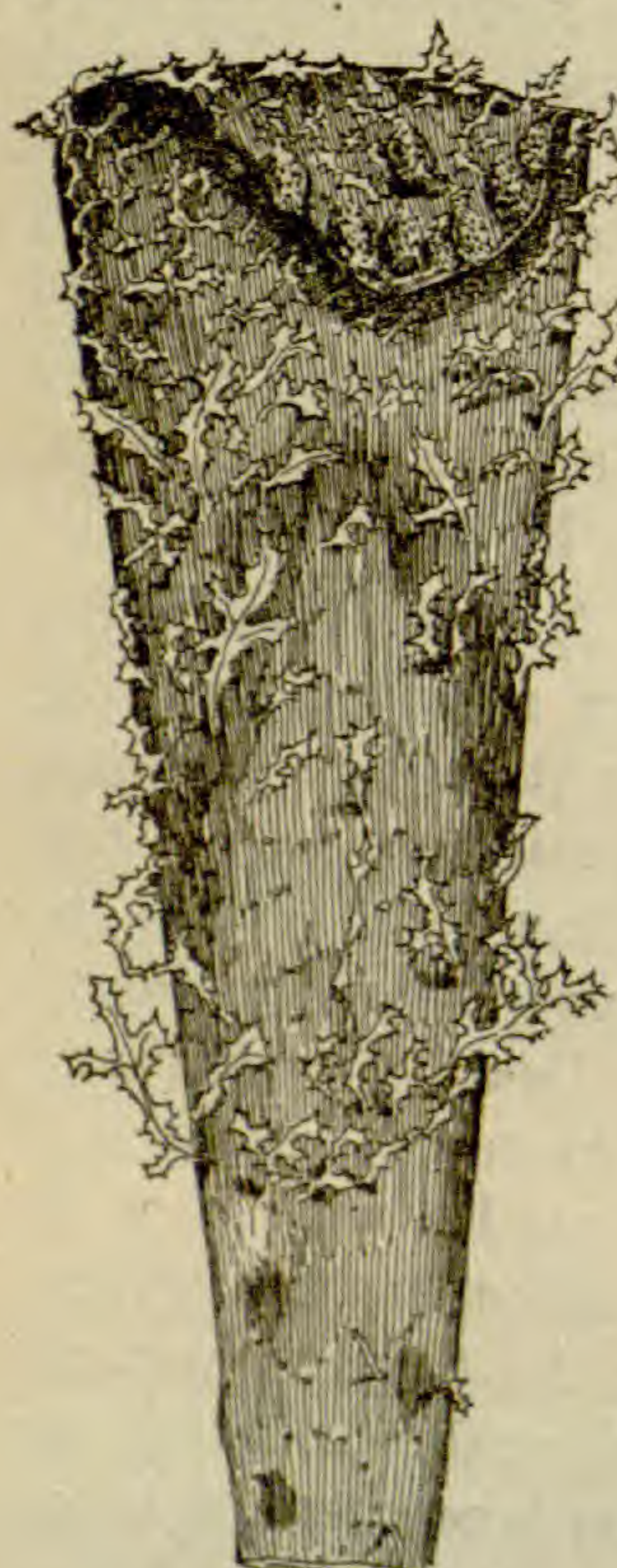
An abnormal water-pore.— The accompanying figure illustrates a curious water-pore found by Mr. E. L. Hicks, a student in the botanical laboratory of the University of Wisconsin, while examining these structures on the leaves of *Tropæolum majus.* The four guard cells bound a somewhat trapezoidal pore, *A.* The whole apparatus reminds one strikingly of a stoma of *Marchantia polymorpha.* That it was a functionally active pore was shown by the distinct incrustation of the guard-cells with mineral salts.—C. R. B.



A new grass: Melica? multinervosa.— Culms from a strong creeping rhizoma, about 3 ft. high, somewhat thickened at the base, erect, smooth, frequently geniculate below, the lower nodes hairy: leaves four or five, narrow, rather rigid, 6 to 12 in. long, becoming involute; lower sheaths much longer than the internodes and open above, upper sheaths shorter; ligule a prominent ring of hairs: panicle erect, 6 inches long, the branches single, the lower ones 3 inches long, flowering above the middle with 3 to 6 single, alternate, short-pedicelled, approximate spikelets, the upper branches gradually shorter, above nearly sessile, the lower branches spreading somewhat in flowering; rachis angular, scabrous, hairy in the main axils: spikelets spindle-shaped or linear-lanceolate, 6 to 9 lines long, 8 to 12-flowered, slightly compressed, the flowers imbricated, purple on the margins; empty glumes somewhat unequal, the lower 2 lines long, 1- or faintly 3-nerved, the upper 7-nerved, both ovate, acutish, not keeled, coriaceous, smooth; flowering glumes ovate, acutish, slightly thinner than the empty glumes, rounded on the back, about 7-nerved, 2½ to 3 lines long, pubescent on the margins and back below, and thickly pubescent on the rachilla; palet ovate, about 2 lines long, in maturity divided to the base, the two keels winged: stamens 3, included; stigmas 2, plumose; grain concavo-convex, roundish, the 2 thin margins incurved, the 2 thickened styles persistent at the summit.

Collected at Brazos Santiago, Texas, by *G. C. Nealley*, 1891. I place this species doubtfully in Melica, although it differs in several particulars from any species of that genus with which I am acquainted. First, the empty glumes are rather thicker than the flowering ones; second, the upper glume is 7- to 9-nerved; third, the upper flowers of the spikelet are not club-shaped; fourth, the base of the flowering glume and the rachilla are densely pubescent; fifth, the ovary is roundish in outline, concavo-convex with the margins incurved, and 2 thick horn-like styles.— GEORGE VASEY, *Washington, D. C.*

Fasciation in Cnicus lanceolatus.— The most peculiar case of fasciation that ever came under my notice is that of a common thistle (*Cnicus lanceolatus* Hoffm.) recently obtained from Grand Traverse county, in Michigan. The accompanying cut will give some idea of its shape. The specimen where cut off, a few inches above the ground, is 3¼ inches wide. Its greatest width is 11½ inches, the average width being a little over 7 inches and nowhere more than an inch thick. The plant is 3 ft. 7 in. high including the bending top. It does not branch, but for the most part the broad stem is well covered with leaves. The numerous flower heads are sessile or nearly so at the very summit.— J. W. TOUMEY, *Botanical Laboratory, Mich. Agr'l College.*



A new Eriogynia. Notes. — **Eriogynia** (*Petrophytum*, Nuttall) **Hendersoni** n. sp.— A depressed branched plant more or less pilose; leaves green, very slightly if at all sericeous, half to one inch long, spatulate, somewhat abruptly acute, thick, three-ribbed beneath, those of the scapes very small and few, resembling bracts; inflorescence racemose, much more open and loose than in *E. cæspitosa* Watson; pedicels three lines long, usually with a small bract midway, but these sometimes basal on the lowest; calyx-lobes oval, obtuse; disk hairy within, about the length of the calyx-tube and adnate to it except the free crenulate edge—the twenty-five or more stamens inserted just outside the margin; carpels five, each two- to four-ovuled, one- or two-seeded, hairy along the inner edge, oblong-obovate to ovate, the rather rigid styles bent outward; filaments filiform or slightly flattened at the base; petals white, smooth, oblong to nearly orbicular, unguiculate, nearly as long as the stamens; seeds linear; scapes three or four inches high.

An interesting plant, nearest to *E. cæspitosa* Watson, differing especially in the smoother, more robust habit, the shorter and proportionally broader carpels, the shorter and stouter styles and the thick, three-nerved leaves. Except the inflorescence the general habit resembles that of Arctostaphylos alpina. It was discovered on vertical cliffs near the summit of the Olympic Mountains, Washington, at an altitude of 7,500 ft., July 15, 1890, by Prof. L. F. Henderson, for whom it is named; and was also collected in the same region on Sept. 30 following, by Mr. Charles V. Piper.

Mr. J. W. Blankinship collected, July 7th, 1890, in the Big Horn Mountains, Wyoming, at an altitude of 10,000 ft. what seems to be good *Erigeron Tweedyana* Canby & Rose.

Prof. E. L. Greene has issued some advance sheets of Pittonia, vol. ii, pp. 159–166, July 1st, 1891. On page 162, a plant is described as new under the name of *Tellima nudicaulis*. This is evidently the same as Nos. 119 and 52b of the collections of the Northern Transcontinental Survey, distributed by me under the MS. name of *Tellima pentandra* and which Prof. D. C. Eaton described as *Heuchera Williamsii* in BOTANICAL GAZETTE, vol. xv. p. 62 (March, 1890). If a Tellima—and I still think it accords better with that genus than with Heuchera—it should probably bear the original name of *T. pentandra*, as given in Prof. Eaton's article. Some botanists, however, may insist on using the specific name which it bears under Heuchera, in which case it would be *T. Williamsii*.—WM. M. CANBY, *Wilmington, Del.*

EDITORIAL.

THERE IS a certain fixity necessary in the terms which are used in descriptive botany; yet if anyone will compare descriptions of plants written 100 — or even 50 — years ago with modern ones the changes that have occurred in terminology will be striking. These changes have crept in almost unperceived in most cases, and have been made in deference to modifications in the morphological concepts. But if the list of terms now in use be scrutinized it will be seen that many do not in the least correspond to the present views of the morphology of the parts. Note for example the terms relating to the flower mentioned by Prof. MacMillan at p. 178; and further such as acaulescent, adnate (anthers), albumen and plumule for the Phanerogams; stipe and frond for the Ferns; areolation, apophysis and acrocarpous for the Mosses; and a host of others that might be specified.

WHAT SHALL be done with such terms? Drop them and substitute the more correct ones, says the morphologist; whereat the systematist raises his hands in holy horror, because the necessity for change does not appear. Nor it is likely that it can be made obvious to him. He is looking at the blue side of the shield; the morphologist at the white. Here is an opportunity for the botanical congress of 1893. It may wisely undertake not only to unite systematists in some common action regarding nomenclature, but take steps toward revising the inconsistent terminology of the science.

WE SAY "of the *science*," for morphology is by no means guiltless in this matter. The most thorough attempt to revise the terminology of the reproductive organs of cryptogams was made a few years ago by Bennett and Murray. Though not wholly consistent nor wise, the move was in the right direction and their suggestions might serve as a basis for future revision.

CURRENT LITERATURE.

The Podostemaceæ.

Warming's paper on this family[1] contains an admirable account of the characters of this small, but very interesting family, the position of which, formerly in dispute, the author states to be close to the *Saxifragaceæ*. Several years ago Mr. Warming made a special study of this family, and the present paper contains most of the results of the investigations, which have been made with his usual acuteness in morphological and anatomical questions. The structure of the vegetative organs is peculiar. The roots of these plants show in several species a function, corresponding to that of a rhizome, and have hitherto often been considered as identical with a "thallus" or a "stem." They are always dorsiventral and often strongly flattened; one genus, *Tristicha*, is, however, according to Cario evidently destitute of any kind of roots. As to the internal structure of the roots, there is neither any endodermis nor pericycle, but the central-cylinder is surrounded by a collenchymatic tissue, which is especially strongly developed on the dorsal face; the groups of leptome occupy the dorsal face of the central-cylinder, and are not in alternation with the groups of hadrome, here being situated on the ventral face. The groups of hadrome, commonly two, contain a few narrow vessels, but seem, however, in some cases to be entirely wanting, thus the cylinder looks as if it merely consisted of leptome. The roots showed otherwise a more or less large-celled parenchyma with deposits of starch.

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[1] WARMING, EUG.—Podostemaceæ in Engler und Prantl: Die natuerlichen Pflanzenfamilien III. 2. a. Leipzig: Wilhelm Engelmann. September, 1890.

Two different kinds of organs have been observed as fixing the roots to the substratum: "hairs" with the structure of true roothairs, but with the properties of rhizoids; and the so called "hapters." These last organs have been described more completely in a special paper by the same author[1]. They are exogenous and are constantly developed from the base of the shoots; they show a conical shape as long as they have not yet reached the substratum, but after that they become flattened and show usually a more or less digitate lobation, the lobes closely fastened to the substratum, and exuding a brownish secretion. These "hapters," which remind one very much of similar organs of the *Fucaceæ* and *Laminariaceæ* show a very simple structure, consisting merely of a parenchymatic tissue, in which the author observed the presence of siliceous concretions. The hapters have no root-cap, but are able to regenerate like true roots.

The shoots are developed in acropetal succession from the sides of the flattened roots, or in some cases a little towards the ventral face; they appear usually in pairs, more or less opposite, and are developed from the outermost layer of the bark, without being in contact with the central-cylinder. They resemble the roots fixed to the substratum by rhizoids and hapters, and are more or less dorsiventral.

The leaves show a great variation in size and shape; the first developed are scale-like, succeeded by the mostly alternating proper leaves, the blade of which may vary from simple and very small as in *Tristicha* and several species of *Podostemon*, until larger and deeply cleft as in most species of this family.

The paper is illustrated by 17 figures, mostly original and finely drawn by the author himself.— THEO. HOLM.

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[1] Botanische Notizen. Bot. Zeitung, 1883.

Forest trees of North America.[1]

This brochure of plates will come as a surprise to almost every botanist. Very few, even of Dr. Gray's friends, were aware of the existence of these plates or of the projected work which they were intended to illustrate. They were stored at his house and after his death were sent to the Smithsonian Institution whose property they were. The 300 copies are now "distributed to the principal botanists and museums of the world as mementos of the distinguished man who gave so much of his life and labors to this department of knowledge." The few plates now published (from Mr. Isaac Sprague's admirable drawing) make us wish that the expensiveness of the undertaking and Dr. Gray's preoccupation had not prevented the preparation of text and the completion of the work. We may well congratulate ourselves, however, that the Secretary of the Smithsonian Institution has authorized the distribution of them, even in their incompleteness.

Botanist's Directory.

The useful Correspondance Botanique of Morren having become antiquated Wilhelm Engelmann of Leipzig, the well-known publisher, has issued a list of living botanists, of botanical institutes, societies and periodicals[2].

The compilers are hidden behind the term "Fachmänner." Of course one looks first at the addresses of his own countrymen. For the United States we find many of them sadly awry, and it is a pity that the MS. or the proof was not submitted to some American "Fachmann." We could name a dozen who could have corrected three-fourths of the errors and have added many names worthy of insertion. However, the main value of the book to Americans lies not so much in the accuracy of the American addresses as in those of foreigners. We may well believe that for the continent of Europe at least the work much surpasses in fullness and accuracy the United States section. It is sure to prove of great use to all who have any European correspondence or who wish to be able to distribute papers or specimens wisely. The addresses are grouped by cities, and an index of persons and one of places at the end enables one to find any address of which he has even an inkling. The publisher will be grateful for notice of corrections. We hope that American botanists will see to it that their addresses are correctly given in future editions.

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[1] Botanisches Adressbuch. Verzeichnis der lebenden Botaniker, sowie der botanischen Anstalten, Gesellschaften und Zeitschriften, herausgeben von Fachmænnern. 8 vo. pp. 186. Leipzig: Wm. Engelmann, 1891.—M. 5.

[2] Gray, Asa.—Plates prepared between the years 1849 and 1859, to accompany a report on the forest trees of North America. 4°. pp. 4. plates 23, colored. Washington: Smithsonian Institution. 1891.

OPEN LETTERS.

The home of Calypso.

Some years ago, while making a botanical exchange with Prof. W. W. Bailey, the poet-botanist of Rhode Island, I was accused by him of prodigality, because I sent him so many specimens of Calypso borealis. But I could then afford to be prodigal, for I was located in the very court of the goddess, viz:– the cedar region of northern Vermont.

Two years ago I met, at his summer home under the shadow of Mt. Lafayette, the genial author, botanist and world-wide traveler, Dr. Prime. To him I boasted that in half a day I could gather, in Caledonia Co., Vt., fifty specimens of Calypso. He thought that, in Essex Co., he could, in the same length of time, gather a hundred. The two counties are adjacent, and cold, cedar swamps abound in both. Even there it must be reckoned as a very rare plant; but I have wondered if, in any other state, it is as little rare. It is found in Maine, on the Mohawk, in Wisconsin and Minnesota, in Oregon and Washington, and in the British provinces. But, if one may judge by the parsimony which most collectors evince in parting with specimens, it is nowhere found as plentiful as in the locality mentioned.

It prefers the shade of the arbor-vitæ. It grows on low, moist ground — not wet ground — but on knolls a foot or so above the swamp level. A mass of dead Sphagnum overgrown by a thick layer of Hypnum is its favorite bed. The corm and roots rest entirely in the moss, seeming to have little or no connection with the underlying humus. Two or more corms are often united, the one of the preceding year persisting.

Though searching carefully, I have never found fruit. This must be from lack of fertilization by insects. At the blooming season — May 15 to May 30 — there are few insects abroad. I have never seen one hovering about Calypso.

The pressed specimen gives but a poor idea of the beauty of the flower. Pressing usually throws the lip up out of position, giving it a ringent, flaunting, turn-up-your-nose sort of a look, but as it grows, the lip is obliquely pendant — as much so as that of Cypripedium acaule. Dainty beauty is the fitting title. It is comparable only to a bright, modest girl dressed in pink. In Wood's Class-Book of Botany (1846), the flower is said to be as "large as that of a Cypripedium". He must have had Cypripedium arietinum in mind, for no other species of native Cypripedium has a flower so small. Of forty specimens of Calypso, the length of lip averages less than three-quarters of an inch, and in some it is barely half an inch. The same specimens give, average height of plant, including corm, 4.9 inches: average length of leaf-blade, 1.3 inches: average width, 1.1 in. Of these, three have two flowering stalks, apparently from the same corm.

Some stations in Vermont where Calypso was formerly found are known to be exhausted owing to clearing of the woodland, but there is comparatively little danger of its extinction in the region of which I speak. In spite of its pink perianth, it is hard to find, and an expert collector might pass it by unseen. Moreover, many of its haunts are likely to be left in timber perpetually. So I think that northern

Vermont may fairly be called the home of Calypso, but if some botanist between Sitka and Superior shall write me that he finds Calypso as common as Carex — why, I congratulate him, that's all.— F. BLANCHARD, *Washington, D. C.*— [See p. 230. EDS.]

NOTES AND NEWS.

J. W. TOUMEY has been elected botanist to the state college and experiment station at Tucson, Arizona.

THE LAST part of a key to the genera and species of British mosses by Rev. H. G. Jameson appears in the July *Journal of Botany*.

THE SUMMER school of botany at Harvard University closed August 1 a very successful 5-weeks session. About 20 were in attendance.

PROF. DR. KARL von Nägeli, of the University of Munich, author of many valuable botanical works, and a philosophical botanist of deep insight, is dead at 74 years of age.

THE LIBRARY of the late Dr. Schenk and that of Dr. Karl Sanio, who died last February, have been purchased by Weigel (Leipzig) and the works will shortly be offered for sale.

DR. EDWARD PALMER, the well known collector, started about the middle of July for a year's exploration of western Mexico. His friends will be glad to know that he is much improved in health and anticipates a very profitable year of work.

VON TUBEUF has lately published a book[1] which contains good and practical hints as to the identification of German forest-trees at a stage shortly after the germination, together with descriptions of the fruits and seeds of the same trees. Although strictly confined to the native or cultivated forest-trees of Germany, the book might undoubtedly be of some interest and use also to American students in this line.— T. H.

C. SAUVAGEAU has made a very comprehensive study of the leaf-structure of the *Potamogetonaceæ*.[2] The principal purpose of his investigations were not only to give a general sketch of the internal structure of the leaf, but also to show the importance of anatomical characters in identifying species, when represented merely by fragments; and finally to illustrate the relation between structure and medium. After giving some introductory remarks concerning the classification of this group and the general influence of medium upon structure, the author describes and figures the leaf-structure of representatives of the *Zostereæ*, *Posidonieæ*, *Potamogetoneæ*, *Cymodoceæ* and *Zannichellieæ*. The paper contains several new observations besides valuable references and comparisons with similar studies, made by others.—T. H.

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[1] Samen, Fruechte und Keimlinge der in Deutschland heimischen oder eingefuhrten forstlichen Culturpflanzen. Berlin, 1891.

[2] Sur les feuilles de quelques Monocotylédones aquatiques. *Dissert.* pp. 200. Paris, 1891.

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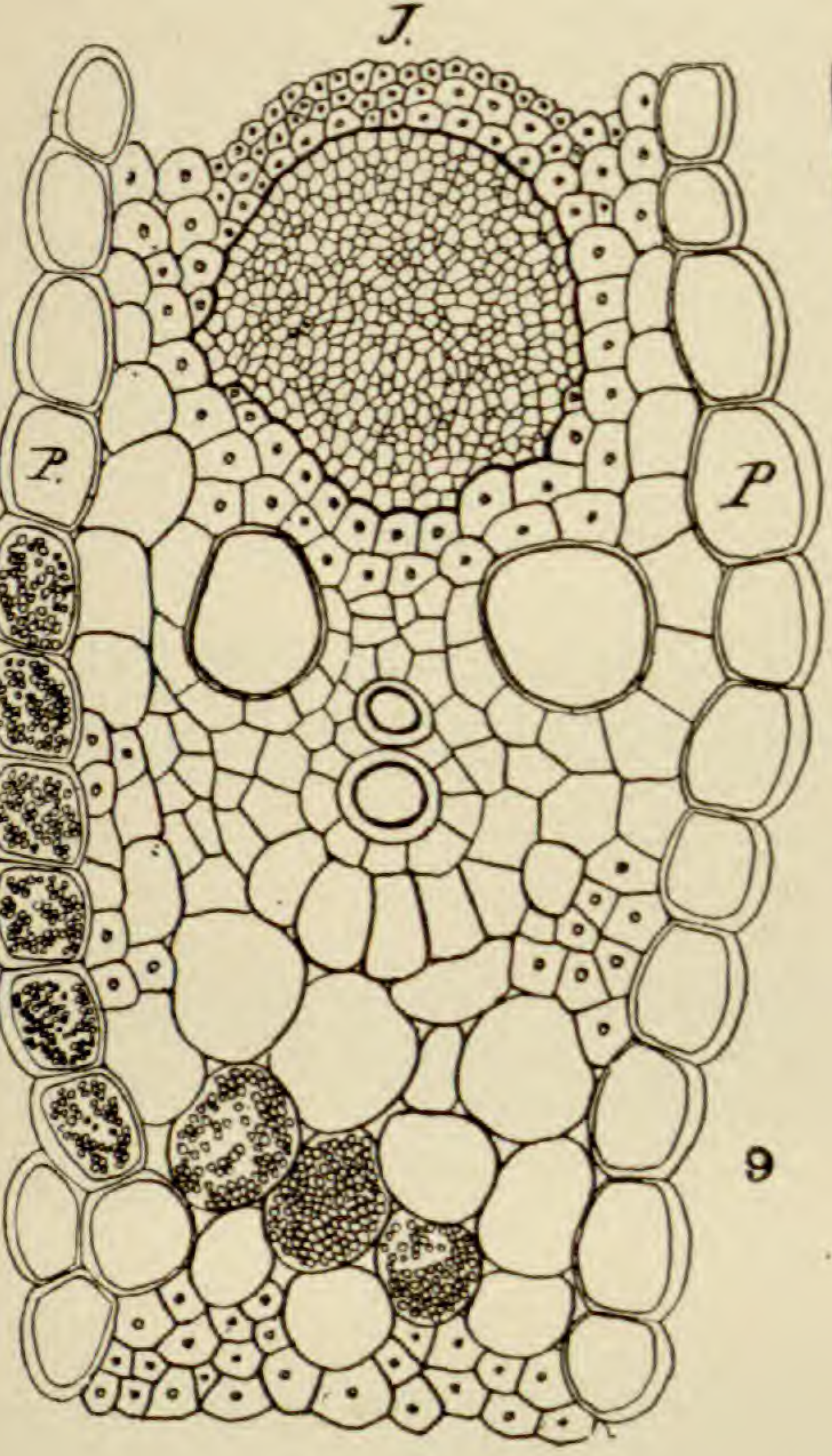

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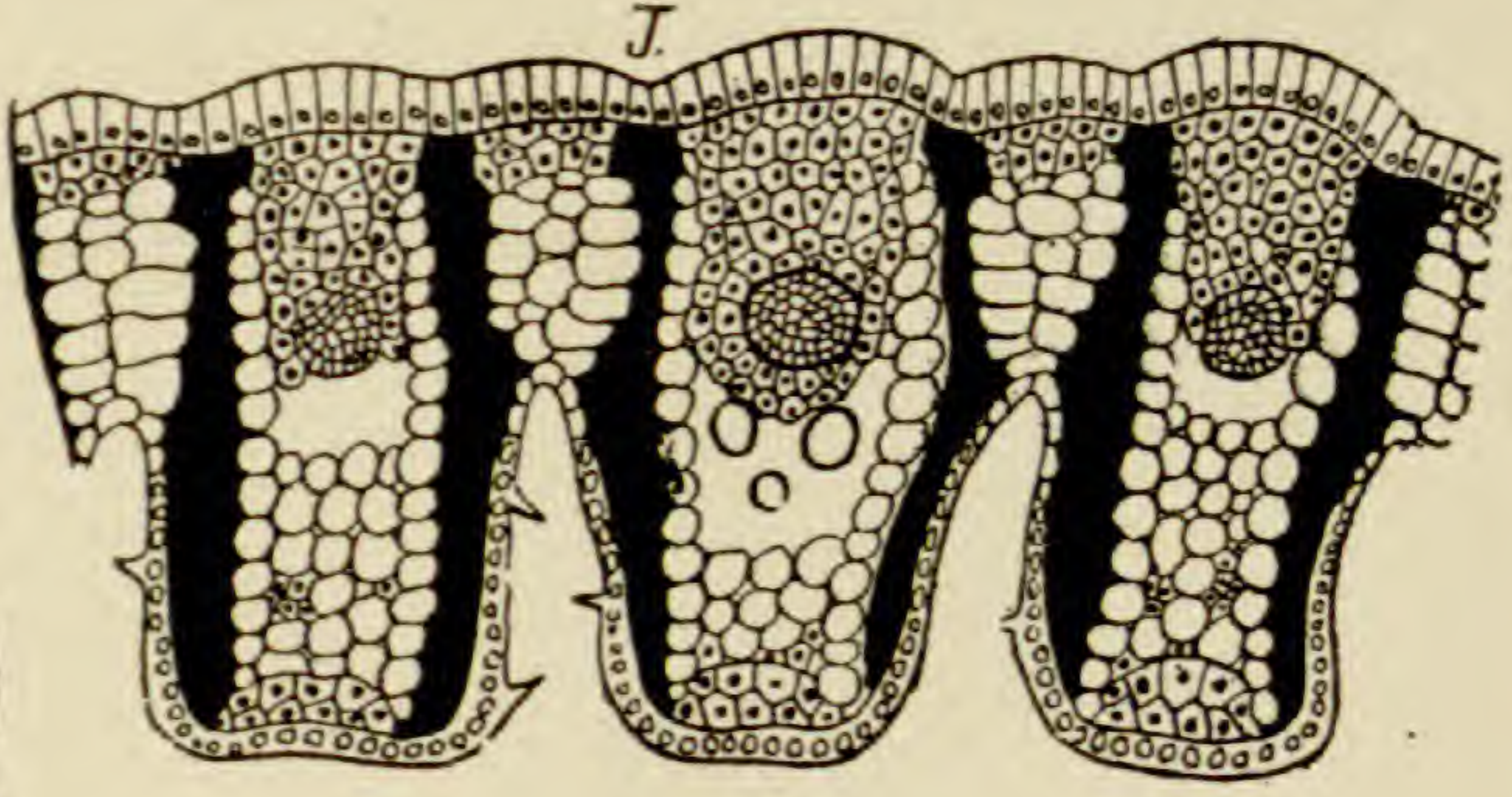

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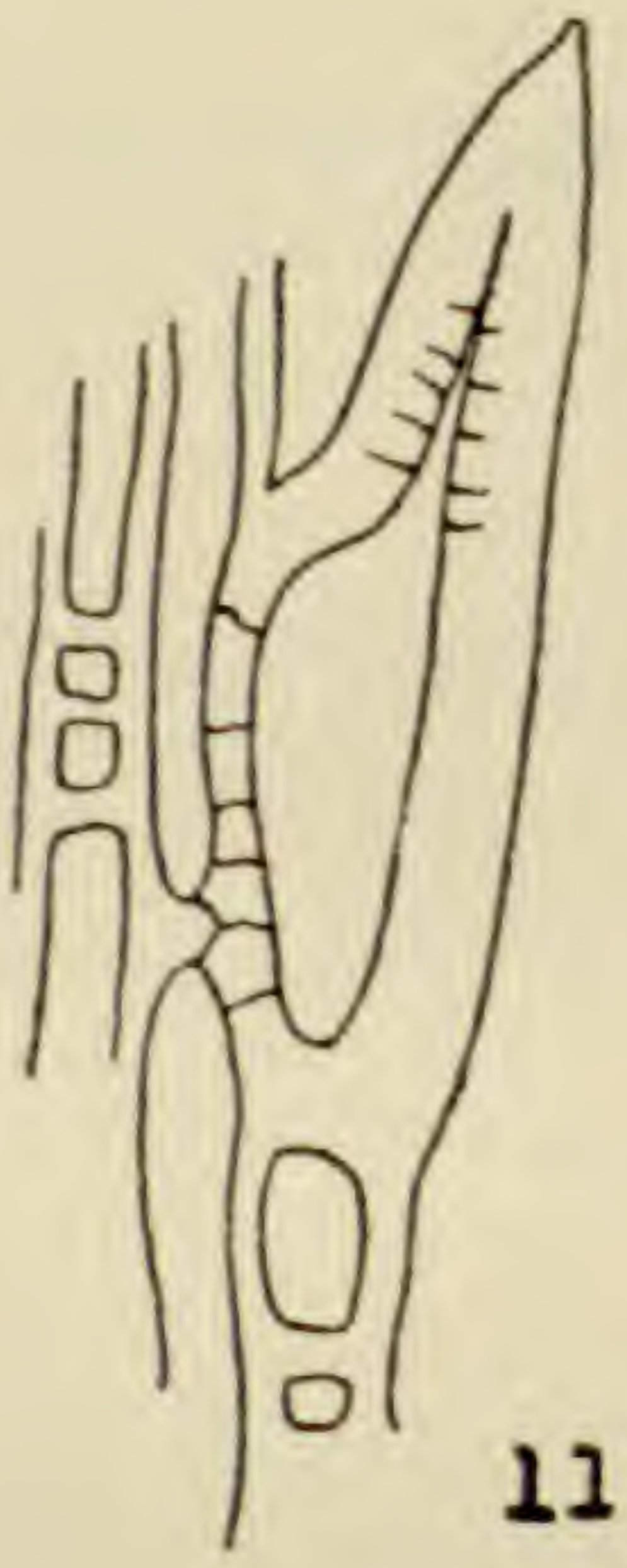

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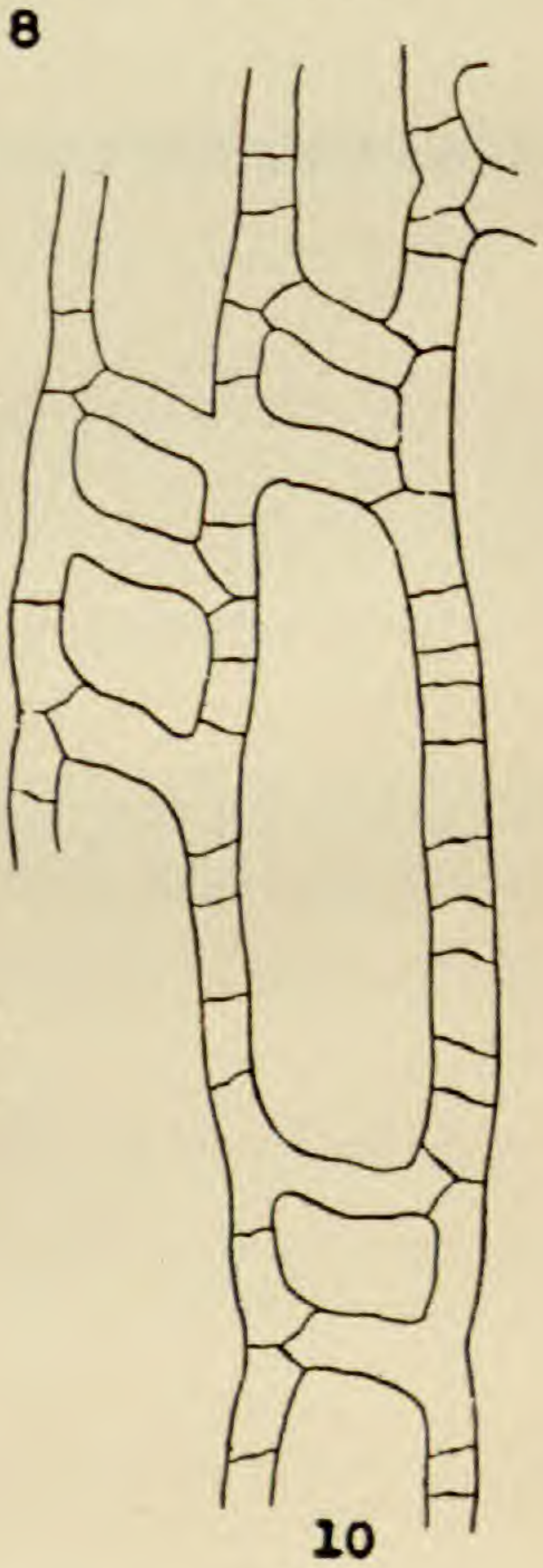

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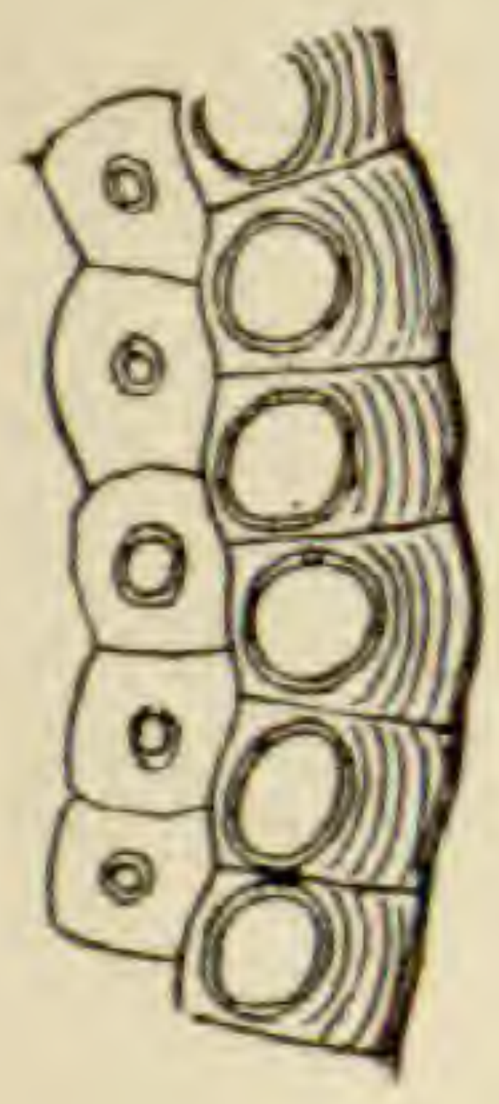

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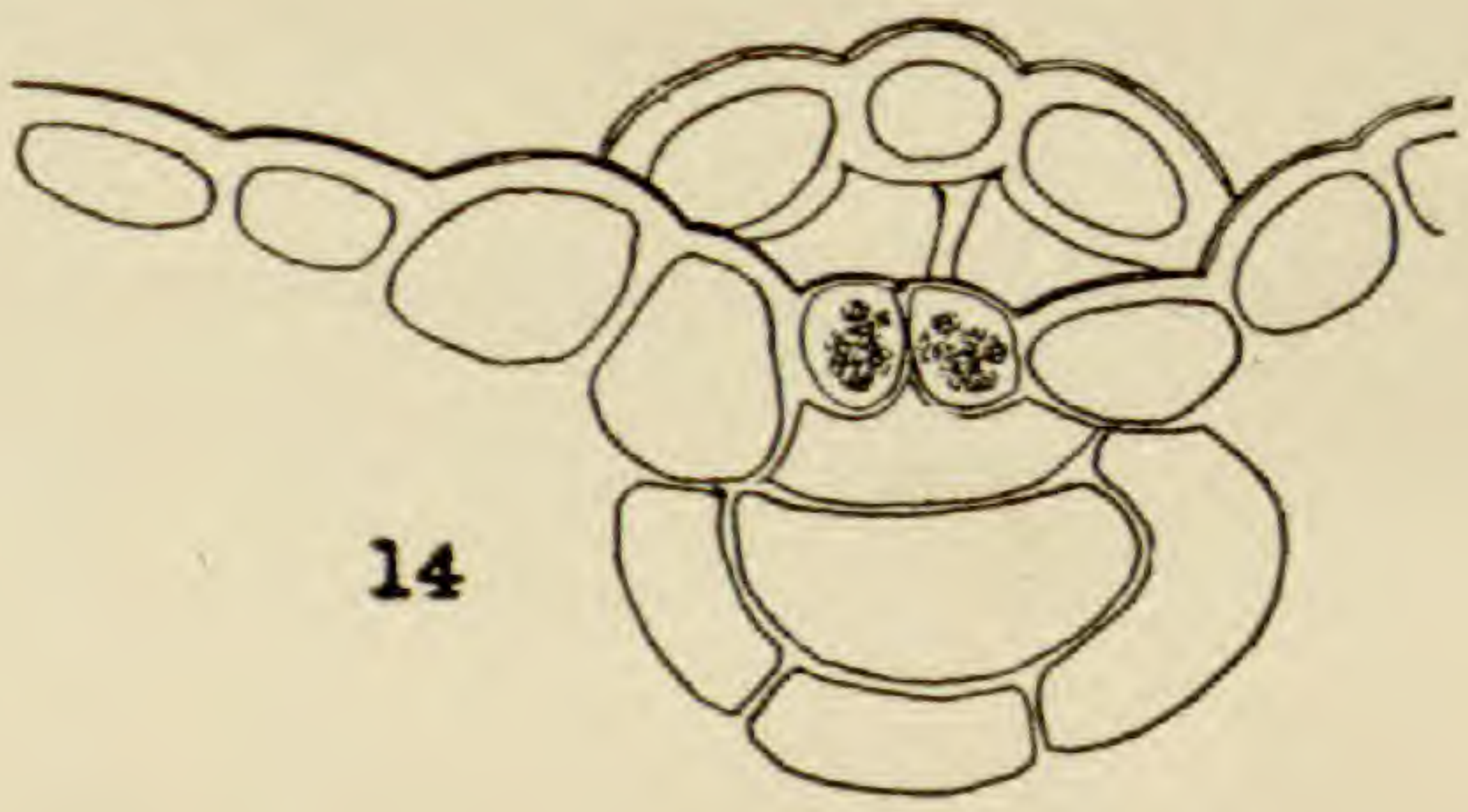

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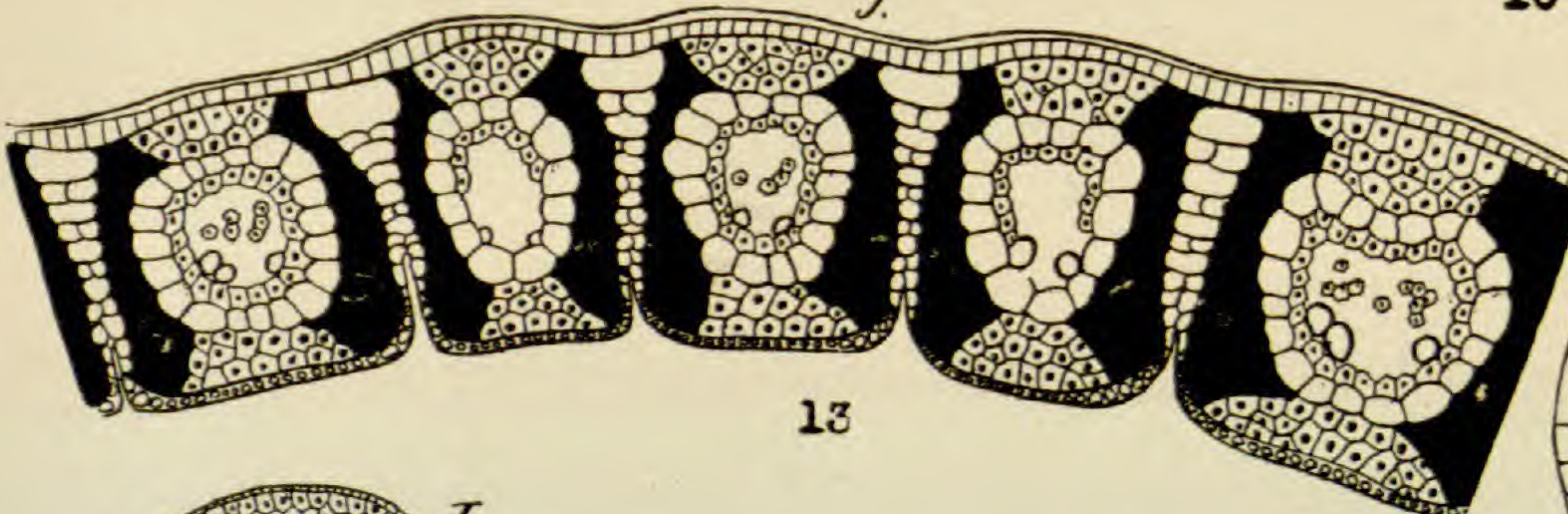

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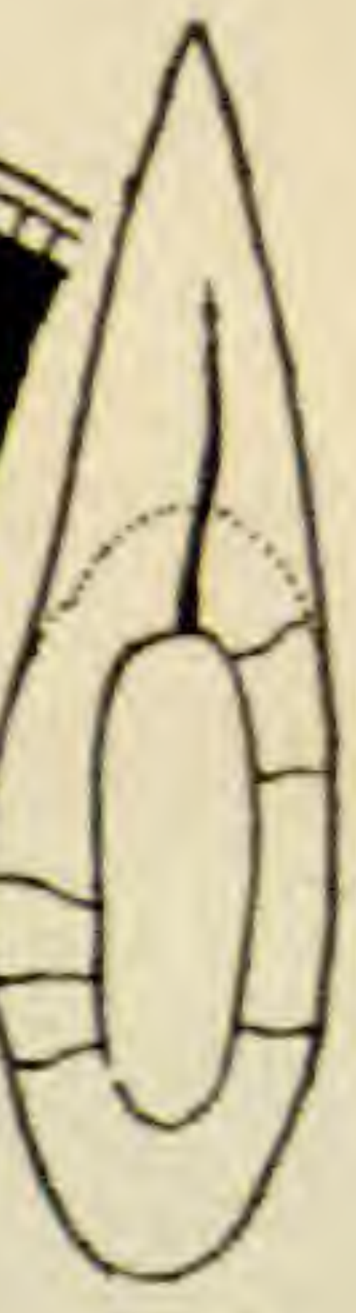

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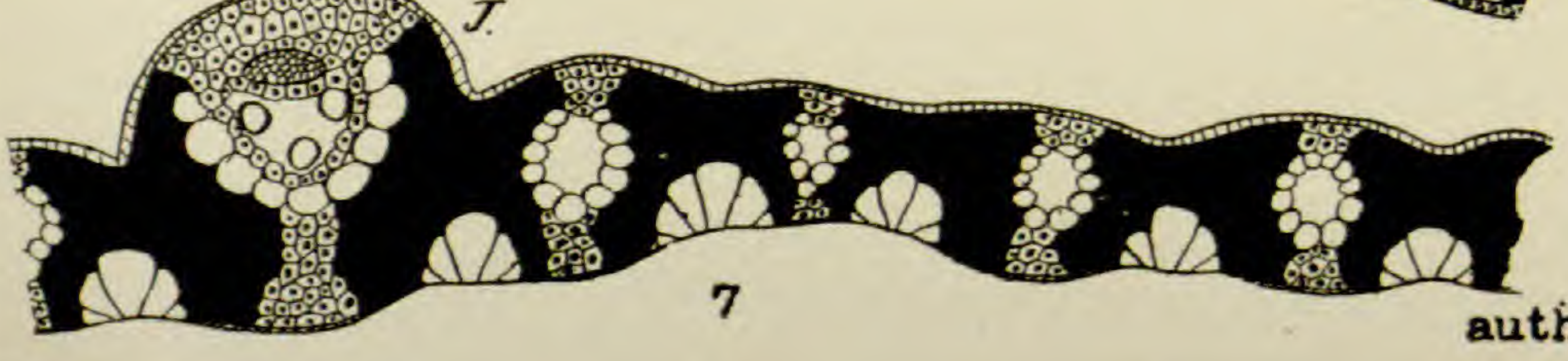

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VOL. XVI. SEPTEMBER, 1891. NO. 9.

THE
BOTANICAL GAZETTE

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CRAWFORDSVILLE, INDIANA.
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Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

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VOL. XVI. NO. 9.—BOTANICAL GAZETTE.—SEPT., 1891.

The Future of Systematic Botany.[1]

JOHN M. COULTER.

In his presidential address before the Biological Section of the British Association, in September, 1888, Dr. W. T. Thiselton-Dyer closed with the following words:

> "At the bottom of every great branch of biological inquiry it has never been possible to neglect the study of plants; nay more, the study of plant-life has generally given the key to the true course of investigation. Whether you take the problems of geographical distribution, the most obscure points in the theory of organic evolution, or the innermost secrets of vital phenomena, whether in health or disease, not to consider plants is still, in the words of Mr. Darwin, 'a gigantic oversight, for these would simplify the problem.'"

If this broad claim be true, a botanical theme is an eminently appropriate one to present to a Biological Section. In the opinion of many, however, all kinds of botanical work are not equally bound up in the bundle of biological inquiry. It is for this very reason that I have selected as my subject "The Future of Systematic Botany."

I know that it is unscientific to deal with the future, although our knowledge of the past and present becomes especially fascinating when we begin to turn it into prophecy. Moreover, upon occasions like this, it is more customary to review and sum up actual knowledge than to cast the horoscope of the future, although the latter is far easier. But, setting aside the custom of presenting either an interesting bit of research or a summarized view of information concerning some attractive subject, I would invite your attention to an ancient, and, to my notion, a much abused department of work. It is perhaps well to say in the outset that the abuse to which I refer is not only that inflicted by Gentiles, but also by Jews; for often one's worst foes are those of his own household.

The ancient history of Systematic Botany is too well known to this audience to need even brief repetition, especially since the masterly sketch by Professor Sachs has found its place in all our libraries. The names of illustrious systematists are household words, and their various "systems" form a part of our training. The one desire which runs with increasing purpose through all this well known history is to reach eventually a natural system of classification. The one obstacle in the way of gratifying this desire has been a lack of knowledge. You remember the time when the knowledge of affinities was so slight that no attempt even was made to express relationships, and plants were simply systematically pigeon-holed for future reference. The ingenuity of those days was taxed to construct the most convenient pigeon-holes, and to properly assign to them the hosts of plants that were clamoring for recognition. Those who could thus properly assort a collection of plants, and could recognize when a new pigeon-hole was needed, were known first as "botanists," afterwards as "systematic botanists," an appellation proper enough, but one unfortunately not having sufficiently outgrown its original application. The unfortunate result of this necessity to systematize facts so rigidly and thus render them readily accessible was, as you well know, to make the pigeon-holes as permanent as the facts they were intended temporarily to contain. A convenience at first became at last a tremendous hindrance, and we are even yet but slowly giving up our firm belief in the reality of the ancient pigeon-hole and its appropriate label. The fact is, that although our belief in them is oozing out, our necessities still compel us to use them; but it is to be hoped that they are being relegated rapidly to their proper position as conveniences, devices of semi-ignorance, and not considered as actual facts.

---

[1] Vice-Presidential Address before Section F., A. A. A. S., Washington meeting, August 19, 1891.

You also recall how knowledge presently became sufficient to justify an attempt at natural arrangement, crude enough, but still advanced enough to mark an epoch in progress; and the authors of these first "natural arrangements" understood their own limitations better than any one else. One natural arrangement has succeeded another, from that day to this, until in those of to-day we have presented to us simply what the earliest contained, viz.: the expression of man's knowledge of affinity; the difference being a slowly diminishing amount of artificial padding. I need not suggest to you how exceedingly imperfect that knowledge is yet, and how, of necessity, the best of our present systems must meet the fate of those that have gone before and become merely chapters in the history of systematic botany. This becomes doubly apparent when it is considered that "pigeon-holing" is going on almost as rapidly as ever; although we may fairly consider that we have now in hand sufficient material for the broadest generalizations. I say "material," not meaning by any means to imply the knowledge which proper investigation of this material is to bring us.

Systematic botany, as formerly understood, has probably done all that it can, unaided, in the natural arrangement of plants. Of course it could indefinitely juggle with sequence and nomenclature, but, after all, that is like arranging a card catalogue, and is of such secondary importance, when the real purpose of systematic botany is considered, that it can hardly be taken as indicative of progress. Let me interject a word at this point. It is my impression that the decriers of Systematic Botany have only in mind this "juggling with sequence and nomenclature" when they make their strictures, and are mistaking the art of the tailor for the evolution of the real man. One must be respectably clothed, but he must be an unspeakable idiot if that is all that can be said of him. It has always been my impression that the depreciation of any other kind of scientific work argues either lack of knowledge or conceit.

But the ancient kind of Systematic Botany was not left without aid, and a group of new departments was made possible by the microscope and the unexampled progress of powers and manipulation. The study of the cell, and of nascent and mature organs, and the recognition of plants as living things that are the resultant of the interplay of internal and external forces, have simply revivified the ancient mummy called Botany, and have made it the living thing it is to-day, capable of endless development. It is not to be wondered at that these new and vigorous departments of work, in the first glow of the vital service they have rendered, should look at the older department as a thing of the past, as something to be buried out of sight, and remembered only as a part of mediæval history. But this is only the first glow of a natural enthusiasm, and I glory in it, for it promises an enormous amount of self-denying work, and the results will all fall into the lap of Systematic Botany. The corpse is not buried, but revivified, and this gush of new work has been but the infusion of an elixir of life into a body that was perishing from starvation.

Some one has said that "the highest reach of the human mind is a natural system of classification"; and Dr. W. T. Thiselton-Dyer, in the address quoted at the opening of this paper, remarks that "such a classification, to be perfect, must be the ultimate generalization of every scrap of knowledge which we can bring to bear upon the study of plant-affinity."

This simply means that when the results of all departments of botanical work are well in hand, then the systematists will be in a position to put on a sure foundation the structure they have always been planning, for it will rest upon known affinities and not upon unmeaning resemblances. To my view, therefore, the real Systematic Botany is to sum up and utilize the results of all other departments; and its work, so far from belonging entirely to the past, is well-nigh all in the future. It is the highest kind of generalization upon an enormous array of facts, and is bound to be the *last* expression of human thought with reference to plant-life, just as it was the *first*. Systematic Botany, therefore, the Systematic Botany which deals with genetic characters, and recognizes the fact that every plant is a living thing with a history and all degrees of consanguinity, and that "the final form of every natural classification must be to approximate to the order of descent," is in its early infancy, and can only develop to completest power when all the facts of plant origin, structure, and life are in. This would seem to make it a slowly developing department of a somewhat endless future, with every distinct advance in knowledge embodied in some "Natural System." These invaluable "systems" will well stand for a series of approximations towards the truth, each succeeding one probably somewhat nearer than the one before, but still far enough removed to stimulate further research.

My position, therefore, is that for the systematists of to-day and of the future there must be three distinct lines of work, related to each other in natural sequence in the order in which I shall present them, and each turning over its completed product to the next.

I. THE COLLECTION AND DESCRIPTION OF PLANTS.—This *preliminary phase* of Systematic Botany is that which most frequently stands for the whole, especially in the minds of those who have been trained in the ancient fashion. It is really strange why this particular and very necessary phase of systematic work has fallen into disrepute among the younger botanists; and I can explain it only by the fact that it is the oldest representative of the science, or that it so frequently stands for all of botanical science in the popular mind, and this popular verdict is resented. With this last position I am thoroughly in sympathy, and it is perfectly proper for the public mind to be disabused and made to understand that botany is a science of living things and not merely of mummies; but this can be best done by treating courteously the ancient and ever to be present and necessary work of collection and description. Such workers are curators of botanical material upon an extensive scale, a function that, properly exercised, requires a skill and patience that few possess, but that many assume.

I grant that the discovery and description of new species is such an inspiring pursuit that it may degenerate into a mania, and sometimes into kleptomania; but the worst of it is that it attracts many who are wholly incompetent, and who have burdened our literature with rubbish that is both discreditable and confusing; but this can be no more true of this than of any other phase of botany or scientific work.

I do not desire to be understood as defending this kind of botanical work, for it needs no defense of mine; but simply, in view of certain fraternal thrusts that have been given, less frequently now than formerly, to call attention to the fact that this is one of the living and necessary kinds of botanical work, subject, like all other kinds, to degradation at the hands of its friends.

While I have spoken of this phase of botanical work as the most ancient, and one which, like the poor, we are always to have with us, I by no means intended to imply that its methods cannot be improved. It must have long since occurred to some that many things besides the mere sporadic collection and recording of species should be included as legitimately belonging to this line of research. It is the common plan to collect and record a plant in such an isolated way that it becomes a text without any context, and is thus robbed of much of its significance. Collectors send in from the field large amounts of miscellaneous material, and usually the only accompanying information is a locality, mostly very indefinite, and a date. In some cases the size and habit is appended, and possibly some local economic note. I take it that this fairly represents the average amount of information obtained from field contact with species; and how meager and unsatisfactory this is can only be appreciated by one who undertakes to make a thorough study of the flora of any region. I have no fault to find with the facts, so far as they go, but they are not half that we have a right to expect from the expenditure of time and energy. There seems to be nothing more unsystematic than field-work in systematic botany. The result is that we know a little about all our floral regions, and all about none, however small. All information that can be obtained in the field concerning species is the province of the collector to procure and of the taxonomist to record. This additional information is important, not merely as additional information, but frequently in correcting errors of judgment concerning species. A species surely holds important relations to its environment, and its characters in some unusual position, or in the penumbra of its range, can hardly be taken as typical; and yet this thing of range and relative abundance, involving centers of distribution, is rarely looked after. What I protest against is the search for species as for diamonds, as things solely valuable in themselves, apart from their surroundings; and what I would urge is the conversion of collecting trips into biological surveys. I know that this means the better training of collectors, that they must be not mere manipulators of drying paper, but scientific men; but is that any objection? I would not for a moment disparage the work of that splendid array of collectors who have triumphed over innumerable difficulties in a self-denying way worthy of any cause, and who have brought to light a wealth of material for which we can never be too grateful; but I would claim that the time has now come when the same amount of devoted labor can be expended to better advantage; and that we must train up a race of field-workers who shall follow their profession as distinctly and scientifically as the race of topographers. In this center of public scientific work in which we have met, devoted to obtaining the largest amount of information in regard to our national possessions, and with means commensurate with the largest plans, it seems an appropriate thing to urge a thoroughly equipped system of biological surveys. This subject is not a new one here, and steps have already been taken to organize some work of this kind, but I desire to voice the sentiment of this section in commending all that has been done in this direction, and in urging that the organization be made more general and extensive.

With regard to the work of description I have little more to say than to express a feeling of regret that it is not always wisely done. This feeling, however, is not peculiar to any kind of work, and it must be always a jumble of good, bad and indifferent. It is simply a case of "let him that is without sin among you first cast a stone," and the man who publishes nothing that he afterwards regrets is either a transcendent genius or a simpleton. It might as well be accepted, however, that description will continue as before, probably in an increasingly miscellaneous way, for there is no feasible way of restricting it, even if it were desirable. We can simply urge, and continue to urge the necessity of long training, abundance of material and literature, and a patience that will be content to wait. Dr. Asa Gray, in a short paper that has never been published, has this to say:

> "The publication of new species is always an anxious business to those fitted for the work and impressed by the responsibility of it, and is lightly undertaken only by those who have no appreciation of the trouble and labor they are giving to the faithful working botanist, both now and hereafter. Some enter upon this seemingly in the spirit in which an ill-disposed person was recommended to throw as much dirt as possible, on the chance that some may stick. The aggrieved author of monographs, floras, and bibliographical indexes has all this dirt (matter out of place) to take care of. He has enough to do in rightly arranging and ascertaining the limits and characters of the species of a difficult genus, without being vexed with riddles which, when solved, often prove to be curiosities of ignorance or marvels of recklessness. The added misfortune is, that superfluous names, however needless or absurd, cannot be buried in oblivion, but must be embalmed in synonymy."

There seems to be abundant indication that, with a better conception of the limitations of a species, the old characters will yield in importance to new ones of deeper significance. The microscope, which was necessary to reveal the existence of any usable characters in the lower groups of plants, is rapidly becoming hardly less necessary for satisfactory systematic work in the highest groups. While the use of gross organs will probably never disappear in specific discriminations, their *exclusive* use must be given up, and such characters will be supplemented by minute ones, which their very minuteness renders of more permanent diagnostic value. You are all familiar with several troublesome groups in which minute characters have already been made of great service in steadying characters obtained from the gross, the largely used, and hence the variable organs. I look upon this as one of the most promising features of the work of future taxonomists of the higher groups.

The serious danger lurking just here is that when one set of characters has proved serviceable in a number of specific or generic limitations the tendency is to make the fabric of the whole group conform to that one set. This gives, of course, a kind of mathematical precision, and every problem is solved by the same formula. But, unfortunately, nature never conforms to such arbitrary rules, and the resulting arrangement may be as purely artificial as those that are confessedly so. The character of a species is an extremely composite affair, and it must stand or fall by the *sum total* of its peculiarities and not by a single one. A specific character in one group may be a generic character in a closely related one, or no character at all. Therefore, there is nothing that involves a broader grasp of facts, the use of an inspiration rather than a rule, than the proper discrimination of species. I have a belief that the arbitrary, rule-of-three mind will never make a successful taxonomist; and that there is a sort of instinct for specific limitations which the possessor cannot communicate to another. This taking into account the total character of a plant, from *facies* to minute characters, will furnish the basis of future descriptive work. The more obstacles that can be put in the way of hasty determination the better.

I have dwelt thus upon the work of collection and description, both to magnify it and to indicate that its proper position is that of a preliminary phase in the study of Systematic Botany.

II. THE STUDY OF LIFE-HISTORIES.—A second phase of Systematic Botany may be called the study of life-histories. It follows the former in natural as well as historical sequence, and, curiously enough, its votaries do not usually class themselves with systematists, although their work is chiefly an attempt to discover affinities. True, they deal in the main with the larger groupings, but this is only possible when a wealth of species is at hand. By "life-history" I do not mean simply that gross observation which watches a plant from germination to maturity, although that must be considered an extremely useful service; but even more that minute tracing, cell by cell, from the primitive cell to the mature plant, a work which is now conceded to reveal more of the deep secrets of affinity than perhaps any other. The tremendous amount of material to be thus investigated, and the numerous obstacles to be overcome, have been the chief stimulus of recent botanical activity; and there has sprung into existence a race of workers whose powers of manipulation are little short of marvelous. These observers are bringing the hidden things to light, and out of the facts they are accumulating is to be constructed the Natural System. But the field is comparatively a new one, and the material so exhaustless that it can well satisfy the ambition of the most diligent. I would consider this work of searching for the affinities of great groups the crying need of Systematic Botany to-day. The need is so evident, and the work so attractive, that there is no lack of numbers in those who are undertaking it. The multiplication of facilities for this work is all that could be asked; but too often "facilities for work" and a little knowledge of technique are considered to be the only things necessary for this difficult kind of investigation. The consequence is that "life histories" have been published which are not histories of any living thing. The amount of work to be done is so great, and the use to be made of the results is so important, that incompetent work is peculiarly exasperating. Nothing is more capable of misinterpretation than the observations made in work of this nature, and the tendency to generalize upon few or even doubtful facts is a constant temptation.

It is really a question as yet, whether, even among skillful investigators, too much stress is not laid upon certain single characters, and the sum-total of development not sufficiently considered. There is a marked tendency to select certain parts of certain organs and square the affinities of the whole organism by these, rather than to consider them in the light of cumulative testimony, to be used in connection with others. The tendency is not pernicious, for it is rapidly accumulating a vast amount of partial testimony, but the broadest generalizations concerning affinity cannot be made until every part of every organ is considered, and the position of the organism be made the resultant of all. There is no question but that certain periods in the development of a plant, or certain important organs, notably the sexual ones, are freighted with deeper meaning than others and rightly exercise a dominating influence in determining affinities; but development at every period, and of every organ, must eventually be taken into account before the last word can be spoken concerning a Natural System. The possibilities of adaptation seem so great that it is possible to conceive of two forms closely related in fact, but widely separated by some scheme which depends upon any one set of organs however dominant. For example, this trouble has been experienced over and over again in all presentations of Thallophytes, and will probably continue to be experienced so long as some single key is used to unlock all the mysteries of affinity. I cannot see why a single set of characters used by an embryologist may not result in as artificial a scheme as the use of two or three organs by the taxonomist.

I have thus spoken of the study of life-histories to indicate that its chief function lies in the field of Systematic Botany; to suggest that it take into account development at every period and of every organ, and so obtain a mass of cumulative evidence for safe generalization; and to urge upon those not thoroughly equipped great caution in publication.

I fear that what has been said concerning the great difficulty of the work of the two phases of Systematic Botany already mentioned may be taken to imply that there is nothing here for the poorly equipped but well-intentioned to do. My frank opinion is that there is an abundance of service that such can render, and that their chief function is to bring facts to the notice of those who know how to use them. Very few of us can be architects, but almost any one can carry brick and mortar.

III. THE CONSTRUCTION OF A NATURAL SYSTEM.—This is, of necessity, the last phase of Systematic Botany, and it is evident that its work will not be complete until the two previous kinds of work have been exhausted. The fact is, it must lay under tribute every department of botanical work, and be a compendious expression of man's knowledge of the affinities of plants. It is just here that the work of the tyro is most common and least harmful; for crude systems need not annoy, they can be buried and no law requires their embalming, no necessity compels a verification of their facts, for no facts are used except such as are already known. I venture the assertion that few botanists can truthfully deny that in the early and most ambitious stage of their development they either had in mind, or were rash enough to publish some idea that was to simplify the whole scheme of plant arrangement. This tendency may have soon been checked by wise friends or sad experience, but to attack the largest problems first is as natural as youth itself. I speak of this, not only as a generalization, but also as a reminiscence.

But these Phaeton-like attempts aside, wherein lies the necessity of this most difficult work before the facts are all in, this attempting what is conceded to be impossible? Is it of any advantage to construct a system to-day which must be found faulty to-morrow? It is of the highest advantage to construct any system which shall embody every known fact concerning affinity. Every such system becomes, as ought to be clearly understood, simply an expression of our imperfect knowledge, a convenient summary of information, a sort of mile-post to tell us how far we have come, and to direct future effort. In his essay upon "The Significance of Sexual Reproduction in the Theory of Natural Selection," Weismann uses these words, which are well worth quoting in this connection:

> "Instead of comparing the progress of science to a building, I should prefer to compare it to a mining operation, undertaken in order to open a freely branching lode. Such a lode must not be attacked from one point alone, but from many points simultaneously. From some of these we should quickly reach the deep-seated parts of the lode, from others we should only reach its superficial parts; but from every point some knowledge of the *tout ensemble* of the lode would be gained. And the more numerous the points of attack, the more complete would be the knowledge acquired, for valuable insight will be obtained in every place where the work is carried on with discretion and perseverence. But discretion is indispensable for a fruitful result; or, leaving our metaphor, facts must be connected together by theories, if science is to advance. Just as theories are valueless without a firm basis of facts, so the mere collection of facts, without relation and without coherence, is utterly valueless. Science is impossible without hypotheses and theories; they are the plummets with which we test the depth of the ocean of unknown phenomena, and thus determine the future course to be pursued on our voyage of discovery. They do not give us absolute knowledge, but they afford us as much insight as it is possible for us to gain at the present time. To go on investigating, without the guidance of theories, is like attempting to walk in a thick mist without a compass. We should get somewhere under these circumstances, but chance alone would determine whether we should reach a stony desert of unintelligible facts or a system of roads leading in some useful direction; and in most cases chance would decide against us."

It becomes very evident that the work of constructing even a Natural System which must be tentative, a sort of temporary scaffold, is one which demands not only the widest range of information (and hence a task which is daily becoming more exacting), but also that broad grasp in generalization which is possessed by very few. The marshaling of facts is like the marshaling of armies, and very few are born generals. Almost any one can arrange the plant kingdom who is possessed of but few facts, but he who has them all within his reach finds no more difficult task; for it is like fitting together a puzzle of endless pieces.

The question might arise as to the duty of ordinary manuals in this respect, books of limited range, that do not profess to undertake such a path-breaking operation as the construction of a new Natural System. It has always been my opinion that even the most local manual should be an expression of the ascertained facts of affinity. This statement is by no means so sweeping as it may at first appear; for it does not contemplate including the scores of crude notions which are always being advanced, so attractive to many who are naturally restless and mistake change for progress. In the statement made, I desire to emphasize the words "ascertained facts of affinity;" and this is very far from permitting the use of every random notion that may happen to be published. The facts of affinity are slowly accumulating, facts which have reached the dignity of general consent, and it is such that I would always have incorporated even in local manuals, which should not be subjected to the continuous shaking of treacherous ground. I am fully aware that there is a conservatism which is an obstruction to progress; just as there is a galloping rapidity which would land us in the mire; and that we probably all possess one of these qualities in our anxiety to escape the dangers of the other.

The points presented then, in this consideration of the third phase of Systematic Botany are, that the last and highest expression of systematic work is the construction of a Natural System, based upon the accumulations of those who collect and describe, and those who study life-histories; that this work involves the completest command of literature and the highest powers of generalization; that it is essential to progress for a Natural System to be attempted with every advance in knowledge; and that all the known facts of affinity, thus brought within reach, should be expressed in all systematic literature.

In conclusion, I have but to say that I have attempted to indicate the true relation which exists among the different phases of Systematic Botany; to point out an affinity which there is danger of ignoring; and to maintain that all these departments of work, looking to the same end, are equally important, equally honorable.

Indiana University, Bloomington, Ind.

Botanical papers at the Washington meeting of the A. A. A. S.

At this meeting, beginning August 19, an unusually large number of botanical papers were presented, of which we give the following abstracts:

The possibilities of Economic Botany: the address of the retiring president of the association, DR. GEORGE L. GOODALE.—The address was introduced by a brief description of the speaker's recent trip through Australasia and Japan, where many of our possible economic plants were met. Many examples were given of the useful plants which mankind may hope to employ in the near future. The assertion was made that if all our present cereals were swept out of existence our experiment stations could probably replace them by other grasses within half a century, the methods being selection and hybridization. New vegetables may reasonably be expected from Japan, a country whose flora has such remarkable resemblance to our own. The fruits of the future will tend more and more toward becoming seedless, just as certain fruits are now. All the great groups of economic products were taken up in turn and their possible improvement described. The speaker urged the importance of the establishment of a series of gardens in different parts of the country, where experiments can be carried on in hybridizing and selection, and expressed the opinion that such establishments should be neither governmental nor academic. A complete abstract of the address is not possible, as it was a collection of facts that cannot be condensed. The paper will be published in full in the *Am. Jour. of Science* for October, and also, translated into German, in the Pharmaceutische Rundschau. It is an exceedingly valuable contribution to the literature of Economic Botany.

Illustrations of heredity in plant hybrids: DR. J. M. MACFARLANE, of Edinburgh University.—This address was the public lecture of Friday evening and was fully illustrated by the use of three lanterns, showing side by side the structures of each parent and the hybrid. The points made were as follows: Some hybrids are exactly intermediate in histological details between parents. Parents in such cases are nearly related histologically and the progeny often fertile. Some hybrids while intermediate in most details inherit two diverse structures peculiar to each parent. Such hybrids are usually largely sterile. Effects of heredity were traced in flowering period, color, chemical constitution and powers of resistance, showing that an organism is normally an equal blending of both parents. Explanation was offered of cases where the offspring resembles one parent rather than another.

The future of Systematic Botany: JOHN M. COULTER.—The vice-presidential address is printed in full in this issue.

The botanical papers before section F were as follows:

On the structure and dimorphism of Hypocrea tuberiformis *B. & Rav.:* GEO. F. ATKINSON.—H. tuberiformis was described by Berkeley in *Grevillea*, 4. 13, from specimens collected by Ravenel in S. C. It was also distributed in Rav. Fung. Am. n. 733, and in Rav. Fung. Car. n. 52. The perfect stage has never been described. Patouillard described a new genus *(Dussiella)* from specimens of a fungus in the Berlin Museum, which was wrongly determined as *Hypocrea tuberiformis* B. & Rav. It was collected in Caracas and is very different from the American specimens on Arundinaria, the perithecia being entirely immersed in the stroma and accompanied by paraphyses, while in the American specimens the perithecia are sessile and stand on the stroma "like the young horns of Podosma macropus." The fungus is closely related to Epichloe, but as the stroma does not entirely surround its host it would fall into the genus unnecessarily erected by Saccardo, and for the time being would read *Hypocrella tuberiformis* (B. & Rav.).

The spectroscope in botanical studies: I. A. BRASHEAR.—A simple method of studying the selective absorption and reflection of flowers and leaves by means of the spectroscope was suggested. The author gave the results of a number of studies on the colors of flowers and leaves, illustrating results by means of diagrams.

On the prothallium and embryo of Osmunda Claytoniana and O. cinnamomea: DOUGLAS H. CAMPBELL.—The author treated at length the structure and germination of the spores, the development of the prothallium, the structure and development of the sexual organs, fertilization, the development of the embryo with comparison in the two species; closing with a comparison of the development with that of other Pteridophytes, and a discussion of the systematic position of the Osmundaceæ.

On the phylogeny of the Archegoniata: DOUGLAS H. CAMPBELL.—In this paper, in a certain sense a sequel to the preceding, Dr. Campbell detailed the different views held as to the relation of Hepaticæ and Musci to each other and to the Pteridophytes, and stating the hypothesis as to the primitive nature of the Eusporangiate Pteridophytes, the author claimed an evident inter-relationship of the different groups of the Hepaticæ, showing the connection between the thallose and foliose Hepaticæ, and between the former and the mosses. A comparison of the Pteridophytes and Hepaticæ was followed by a consideration of the relationships of the Pteridophytes *inter se*, of heterospory among the Pteridophytes, and of the relation to Gymnosperms and Angiosperms.

Further observations on a bacterial disease of oats: B. T. GALLOWAY.—After a brief review of the paper read on this subject at the Indianapolis meeting, the life history of the organism was set forth, it being shown that the germ may pass the winter on seed from diseased plants, on volunteer oats and to a limited extent in the soil. The characteristics of the germ as regards its behavior on different culture media were given, together with the results of inoculation experiments. In conclusion the experiments in combating the disease and the results obtained were given.

A new Nectria: B. D. HALSTED.—The stem rot of sweet potato is a puzzling disease. As the decay begins near the surface of the ground, and works in opposite directions, usually several fungi are found in the affected parts. A species of Fusarium is uniformly abundant upon the aerial decaying stems. Early in June an ascigerous fungus was found upon the underground portions of the young plants and was first thought to be a form of black rot. It is, however, a Nectria and somewhat closely related to *Nectria Vandæ* Warh.

Notes upon bacteria of Cucurbits: B. D. HALSTED.—Melons, squash and cucumber plants have suffered from a bacterial disease during the present year in New Jersey. The stem decays near the ground and the leaves wilt and "melt" away. The germs are oval in shape and inoculations of healthy plants were successfully made by means of a flamed glass rod. In like manner the disease can be introduced into the stems and leaves of various species of cucurbits. The same bacteria develop with rapidity in ripe tomato fruit upon the vines and spread through the stems of the inoculated plants.

Another chapter in the history of the Venus' Fly-Trap: J. M. MACFARLANE.—It was shown that for mechanical stimulation of leaf *two* touches are needed to cause contraction (unless the stimulus be very powerful), separated by a greater interval than ⅓ of a second. If less than ⅓ of a second elapses, there is no contraction and a third touch is then needed. In the first case no effect is produced if 35–40 seconds elapse between stimuli. By repeated stimuli, with intervals of 40 seconds between, the protoplasm becomes fatigued, so that when the time interval is reduced sluggish movement is exhibited. All parts of the lamina are sensitive to surface stimulation. The author claimed that the explanation of the behavior to stimulating and non-stimulating bodies is to be found in the tetanus of the leaf, first produced by mechanical and later by chemical stimuli. The behavior in this respect of numerous organic and inorganic substances was noted, as was also the agreement of these with Burdon-Sanderson's electrometer results. The nature of the digestive excretion was considered, together with the structure of the leaf in relation to contraction and excretion. The author, in concluding, claimed a perfect parallelism between combined nerve and muscular action in animals, and contraction action in Dionæa. The paper was illustrated by testing the observations made upon some magnificent Dionæas, obtained from the government Botanic Garden.

The Compositæ collected by Dr. Edward Palmer in Colima: J. N. ROSE.—Of the 515 species of plants collected by Dr. Palmer in the State of Colima, 61, or about 12 per cent., are Compositæ. Among these were six new species and two new genera, together with a number of rare forms, some of which had not been collected for more than 100 years.

The Flora of Carmen Island: J. N. ROSE.—This contained a sketch of the collections made in this island by Dr. Edward Palmer in 1870 and in 1890, Dr. Palmer being the only collector who has ever visited the locality. The total number of species obtained was 70, and of these six are new. Grouping the plants into Polypetalæ, Gamopetalæ, Apetalæ, and Endogens, it was found that of polypetalous forms there were 21 species, 7 of which were Leguminosæ; of gamopetalous 24 species, 12 of which were Compositæ; of apetalous 10 species, 6 being Euphorbiaceæ, and of endogens 13 species, 12 being Gramineæ. Twenty-nine of the species have been reported from Mexico and forty-nine from Lower California.

Uses of the fermentation tube in bacteriology: THEOBALD SMITH.—The object of the paper was to call attention to the value of the fermentation tube in the differentiation of closely allied species or varieties of bacteria, in the preliminary study of gas production and in the cultivation of anaerobic forms. It was also shown to be very useful in the class room in demonstrating the very active metabolism of bacteria as indicated by the rapidity of gas production.

Botanical field work of the Botanical Division: GEORGE VASEY.—This paper gave an account of the field work or botanical explorations which are being conducted by the Botanical Division of the Department of Agriculture. The sketch included an account of the work in Texas, with a list of new species; the bulletin of the Texas Flora; the work in Arizona and in Mexico, with an account of some species of special interest; the Death Valley Expedition; the special investigations in Cactaceæ; the explorations in Indian territory, N. E. Minnesota and Wisconsin, and in Florida.

Results from recent investigations in pear blight: M. B. WAITE.—Pear blight is a disease which works only in meristematic tissue. After explaining twig and blossom blight and detailing methods of study the writer gave some of the characteristics of the germ blight. It is a motile bacillus. The blight bacteria grow in the nectar and multiply there as saprophytes and then enter the tissues. The bacillus of blight in the nectar is carried from flower to flower by insects visiting the flowers for pollen and honey. An artificial epidemic of pear blight was started by infecting a few trees on the edge of an orchard and allowing free access of insects. Protecting the flowers from visits of insects will protect from blight.

In addition to the above papers, the four following were presented, by appointment at the Indianapolis meeting, under the general title of *Plant Physiology*.

Transpiration, or the loss of water from plants: CHARLES E. BESSEY and ALBERT F. WOOD.—The historical summary of the investigations upon transpiration was followed by a discussion of the methods of observation and the nature of transpiration. The paper closed with a summary of the views of the principal investigators.

Absorption of fluids by plants: L. H. PAMMEL.—The paper opened with a résumé of the work upon the absorption of fluids by plants, considered historically, anatomically and physiologically. The subject of soils was then considered as bearing upon the absorption of water. The distribution and occurrence of root hairs on plants with an exposition of the way in which absorption was brought about was then discussed, the paper closing with an account of the absorption of fluids by Cryptogams.

Movement of fluids in plants: W. J. BEAL.—The author gave a résumé of the subject, speaking chiefly of the movement of fluids in trees. His remarks were confirmed by a number of experiments that he had performed for verification.

Gases in plants: J. C. ARTHUR.—The writer gave a brief historical statement of the discovery of the principal facts pertaining to the subject; the kinds and origin of gases in plants; and an account of the present state of knowledge regarding the movement and distribution of gases in plants.

Two papers of botanical interest were read before section C (Chemistry).

The biological function of the lecithins: WALTER MAXWELL.—In a paper presented before the association in 1890, it was shown that during the initial stages of plant growth, the phosphorus contained in the mature seed as a mineral phosphate, under the action of the process of germination, becomes separated from the inorganic compound and reappears in the organisms of the young plantlet in an organic form as lecithin, and that the lecithins form a medium through which the element phosphorus passes from the mineral to the vegetable kingdom. A continuance of the study of the functions of the lecithins, which has been conducted with the normal hen's egg and the incubation products of the egg, have indicated that the phosphorus contained in the egg in the organic form as a lecithin, under the action of the process of incubation, becomes eliminated from the lecithin compound and reappears in the mineral form as a phosphate, and is utilized in the production of animal bone. It thus appears that the lecithin bodies are a channel through which the circulation of the element phosphorus is conducted, passing from the mineral, through the vegetable and into the animal kingdom.

Raphides the cause of the acridity of certain plants: H. A. WEBER.—Chemical tests show that the reason why some plants, like Arisæma, are acrid, while others also abundantly supplied with raphides, like Tradescantia, are not acrid is because the latter have the bundles of raphides surrounded by an insoluble envelope, not present in the former. In the one case the raphides are readily dissolved in the mouth and produce the biting sensation ; in the other case they do not dissolve and consequently cannot be tasted.

Botanical Club of the A. A. A. S.

The meetings of the club were held from 9 to 10 A. M., on Thursday, Friday and Saturday of the session of the Association. They were well attended, quite as well in fact as the Section of Biology which followed later in the day. The number of papers presented was unfortunately limited by the brief sessions, but they were of more than usual interest. The following is a summary of the papers read :

Remarks on some apparatus upon exhibition: J. C. ARTHUR.— A brief description of respiration apparatus exhibited by Dr. Atkinson and himself, and also of some other pieces of physiological apparatus. A student's reagent case was also exhibited by Prof. Beal.

The perfect stage of Cercospora gossipina: GEO. F. ATKINSON.— An account of further studies upon the life history of this parasitic fungus.

Notes on egg plant diseases : B. D. HALSTED.

Distribution of some fungi : L. H. PAMMEL.—A record of the occurrence of some parasitic fungi during 1891. In discussion Prof. L. H. Bailey expressed the opinion that by extending and increasing such records we might eventually prognosticate with a fair amount of certainty in regard to the probable occurrence of a disease during the coming season, and to state what measures should be taken to hold it in check.

Remarks on a National arboretum: B. E. FERNOW.—After giving reasons why an extensive arboretum at Washington, under the control of the government, would be a valuable acquisition in promoting the development of forestry and allied interests, he presented resolutions addressed to Congress looking to the initiation of such an undertaking. The resolutions were favorably considered, being commended by Messrs. Ward, Riley, Beal, Arthur and others, and were addressed to the Biological Section for further action.

Notes on a new and destructive disease of currant canes: D. G. FAIRCHILD.—An account with drawings and photographs of the dying of the stems, apparently caused by the presence of a mycelial fungus under the bark. No conidial or other fruiting stage was found, although the fungus was made to grow luxuriantly upon slices of potato, agar-agar, etc.

Two new weeds for the United States: J. N. ROSE.—Orobanche racemosa occurs in tobacco and hemp fields in Kentucky, and is also reported from one locality in Illinois. What is locally known as Russian cactus, supposed to have been introduced by Russian Jews, has become a pest in the wheat fields of N. Dakota. It is a species of Salsola. Prof. L. H. Bailey gave an instance of a new introduction spreading at first in a very threatening manner, but which had practically disappeared in four years after. He thought it required a number of years of observation to say with much certainty that a new plant will make a pernicious weed.

The tubercles on the roots of Ceanothus: GEO. F. ATKINSON.—The tubercles discovered by Prof. Beal, and reported upon last year before the Club, were found upon further study to be caused by a parasitic fungus allied to Schinzia Alni, found upon the roots of Alnus and Eleagnus, and now transferred to the genus Frankia.

Notes on the arrow weeds or jumping seeds of Mexico and Central America: C. V. RILEY..—These plants, which are used by the natives to poison arrows, and the seeds of which have a curious saltatory movement due to the presence of an insect in them, belong to several species of Euphorbiaceous plants. The paper was to record, and to call forth further information on the identity and distribution of the species.

Remarks on the souvenirs prepared by the Botanical Club of Washington: E. F. SMITH.—The souvenirs, consisting of a volume of photographs specially prepared, were presented to members of the club, accompanied by a presentation speech conveying the desire of the local club to make the stay of visiting botanists pleasant and memorable.

Changes in the flora of Franklin county, Ohio, during the past 50 years; a note on plant distribution: W. R. LAZENBY.

Notes on some peculiar fungi: MISS E. A. SOUTHWORTH.—Exhibited and described the structure of a tree fungus, forming indefinite white masses of considerable size, which have been described as a new mineral. They appear to be Fries' plant, Polyporus officinale, but their true nature is yet uncertain.

Notes on Bareyeidamia parasitica Karst.: MRS. E. W. CLAYPOLE.—The fungus was found upon decaying onions from the cellar and always associated with another mould upon which it seemed to be a parasitic. It could not be made to fruit upon artificial culture media.

Methods of collecting and preserving Myxomycetes: O. F. COOK.—For the herbarium the specimens are glued to the cardboard, when not too thick, and another card board laid over the specimen, which is kept from crushing it by strips of cork, and the whole placed in the ordinary packet for fungi. When too thick for this treatment, the card to which the specimen is glued is turned bottom side up into a suitable pasteboard box, which has pieces of cork glued to the inside ends, permitting the card to enter the box only far enough to allow the cover to be put on. The two methods are intended to displace the use of pill boxes.

Remarks on a new and destructive herbarium insect: L. H. DEWEY.—This appears to be unusually dangerous for large collections, as corrosive sublimate does not always check it. It is a geometrid moth, hitherto undescribed, looking in its mature form much like the common clothes moth.

New and little known plants of Alabama: CHAS. MOHR.—Among the rare plants mentioned was Quercus heterophylla.

In the discussion which followed Mr. Martindale spoke of the importance of learning still more of the distribution of this species. Mr. Canby thought it a good species. He had specimens in his herbarium from N. Carolina collected by Curtis.

Resolutions were heartily adopted thanking the Botanical Club of Washington for the handsome souvenirs, and for other attentions, which added to the pleasure of the botanists in attendance upon the association.

The following officers were elected for the next meeting: President, V. M. SPALDING, of Ann Arbor, Mich., Vice-President, J. M. COULTER, of Bloomington, Ind , Secretary, D. G. FAIRCHILD, of Washington, D. C.

The Botanical Section of the American Association of Agricultural Colleges and Experiment Stations.—Washington Meeting.

GEO. F. ATKINSON, SEC'Y *pro tem.*

The Section met August 13, in Columbian University, with Chairman B. D. Halsted presiding and Geo. F. Atkinson as secretary *pro tem.* No program being prepared the chairman called upon the members for volunteer papers and discussions.

TRACY, of Mississippi, outlined a plan for the *botanical exhibit at the Columbian Exposition.* Various subjects have already been assigned to specialists, and station workers in botany are requested to suggest other lines of investigation they are engaged upon than those included in the subjects already apportioned. Each one should estimate the amount of space his exhibit would require. The Department of Agriculture will probably provide uniform labels and probably also uniform size and quality of sheets for mounting specimens. Botanists have shown great interest in undertaking the work. Considerable discussion followed in reference to the proper place for the exhibit of fungicides and spraying machinery. The general sentiment seemed to be in favor of a combined exhibit of fungicides and insecticides and machinery, by the botanists, horticulturists, entomologists, and agriculturists. On motion of Mr. Tracy the following resolution was adopted.

Resolved, that the botanical section call the attention of the various heads of the entomological, horticultural, and agricultural sections to the desirability of a collective exhibit of fungicides, insecticides, and apparatus in a single alcove.

ALWOOD, Virginia, made some remarks upon a recent severe attack of *a fungus disease upon apple leaves* in certain orchards in Virginia. Many trees lost 50–75 per cent. of their leaves, and the growth was greatly interfered with, the old orchard at the college being nearly defoliated. He exhibited specimens of the diseased leaves. It has increased in severity during three years. The life history of the fungus has not been studied, but the speaker claimed to have checked the progress of the disease by the use of a weak preparation of the Bordeaux mixture.

BREWER, Connecticut, exhibited some *English walnuts* grown by a friend from seed planted several years ago, also a butternut said to be borne on one of the trees coming from the same seed. As no positive proof could be shown the speaker thought it more likely that the butternut tree appeared there accidentally.

GORMAN, Kentucky, presented (through the chairman) a paper entitled "*A bacterial disease of cabbages.*" A rotting of the cabbage heads was traced to the work of bacteria. Inoculations produced the disease in healthy cabbages. Hot weather and a humid atmosphere are necessary to the progress of the disease. Alwood stated that the same disease occurred in Virginia. Atkinson, Alabama, spoke of a similar disease of turnips at Auburn, in which the interior of the turnips rotted, leaving the outer surface compact. Halsted, N. J., called attention to the undesirability of planting successive crops of cabbages and turnips where *Plasmodiophora* was injurious and suggested that such might be the case with this bacterial disease.

BRUNK, Maryland, spoke of the successful *treatment of Cladosporium fulvum* on tomatoes by using carbonate of copper 3 oz., carbonate of ammonia 1 ℔., with 50 gallons of water. This does not spot the fruit while the ammoniacal carbonate of copper does. The merits and demerits of the various spraying machines were discussed.

At the afternoon session ATKINSON, Alabama, presented notes on some *fungus diseases of the cotton plant*, and exhibited a series of colored illustrations representing the external appearance of the plant affected by the different diseases.

ALWOOD, Virginia, made some remarks on the *artificial pollination of wheat.* He exhibited the varieties of wheat artificially pollinated and the resultant crosses. The method used in the experiments was described in detail.

CRANDALL, Colorado, exhibited the *fruit of the wild service berry* (Amelanchier alnifolia), and spoke of attempts being made to domesticate the fruit.

On the 14th the section was called to order by the chairman at 2:30 P. M.

Officers were elected for the ensuing year: GEO. F. ATKINSON, Alabama, Chairman; L. H. PAMMEL, Iowa, Secretary.

PAMMEL, Iowa, presented some notes on *a destructive disease of the cherry*, caused by a Cladosporium. The damage amounted to 25 per cent. The disease is also common on wild plums.

An informal discussion followed upon the germination of seeds of Vaccinium; the distribution of plants as governed by character of soil, heat, moisture, etc.

HALSTED, New Jersey, presented *Notes upon Monilia fructigena and spore germination.*—This cherry fungus was collected upon excrescences of a wild plum, caused by *Taphrina Pruni*, in Mississippi, and cherries were inoculated with it. These became badly diseased, while the checks remained sound. Inoculation showed that the fungus would grow also upon green and ripe tomatoes, and other vegetable substances, though not so well as upon cherries. The action of fungicides was tested upon spore germination, the cultures being attempted in concave ground slides. A piece of metallic copper foil, thoroughly scoured, as large as the end of a lead pencil, was placed in the bottom of the cell in the water. The spores failed to germinate in presence of this copper foil. Tests were also made with ammoniacal carbonate of copper compound of various strengths, beginning with the strongest, i. e., three ounces of carbonate of copper to one quart of ammonia. Spores were killed by this, also by the half, fifth and twentieth strength. Again one part of the fungicide of vineyard strength was added to ninety-nine parts water. Spores failed to germinate in this, but when washed with pure water several times they germinated. These experiments suggest that perhaps fungi can be successfully combated with fungicides of far less strength than now employed.

BRIEFER ARTICLES.

Oligonema.—In my recent paper upon the new species of Mr. Pringle's last year's collection in Mexico I founded a new genus, *Oligonema*, upon a remarkable asteroid composite. I supposed that I had taken all possible pains to make sure that the name was not preoccupied, but I have since learned through the kindness of Mr. C. F. Peck that there is a genus of the same name among the *Myxomycetes*, established by Rostafinski. As it is necessary, therefore, to make a change, I propose to substitute the meaningless name *Golionema*, formed by simply changing the position of a single letter and in some degree suggestive of the original. The new species consequently becomes **Golionema heterophyllum.**—SERENO WATSON, *Cambridge, Massachusetts.*

EDITORIAL.

THOSE ARE not particularly difficult questions which Professor MacMillan asks in "Open Letters."

The only answer to the first is, "that depends." The answer is certainly not to be found in any cast-iron rules, though the inexperienced may fondly imagine so. If we understand the problems of nomenclature they require a judicial attitude on the part of the student. He has a code of laws—doubtless imperfect; doubtless capable of improvement by the application of the two decades of experience which has been acquired since they were framed—and by the principles set forth in this code he is to be guided. In addition to the code he is to use his common sense — if he has any — in determining what name is to stand. What were the use of the judge on the bench if he have no discretion in the interpretation, application or even suspension of the law in particular cases? To say that the laws of nomenclature are to be inflexible and of universal applicability is quite as absurd as to endeavor to make civil statutes so. It would be wonderfully convenient if this could be attained, even with the law of priority, but it seems quite impossible to secure rigidity without absurdity.

THE ANSWER to the second question, which seems to be addressed to the GAZETTE, is almost self-evident. *There is no self-constituted authority.* He only can be recognized as such whose knowledge and aptitude seem to his fellows to deserve the distinction. The judge does not make himself a judge; he is called to the bench by those who think him qualified to decide nice questions. The GAZETTE recognized Dr. Engelmann as an authority on the Cactaceæ of this country. Why? Not because he proclaimed himself such, but because he knew much about these plants through wide observation and exhaustive study, coupled with a special aptitude for exact and critical research. On a general question, such as that of nomenclature, we recognize as an authority the man who has had experience in untangling its knots, and who has shown himself judicious and accurate as well as acute. We distrust an attempt by a novice, even though he is using "his best bibliographic and analytic ability" to decide the questions of nomenclature which may be raised in a list of a thousand species. But the GAZETTE will warmly welcome the effort of these "young, misguided enthusiasts" to study questions of more limited scope — even questions of nomenclature in restricted groups of plants, provided they take proper pains and time in the study.

On the other hand, good intentions, independence, and a desire to do something are not enough. The now notorious "Farmer's-Alliance judge" in Kansas 'struggled along', 'doing the best he could', 'differed from an authority' (the Supreme Court), 'honestly' (no doubt), 'submitted his efforts to the test of time and the correction of wider and abler research,' and — made himself a laughing-stock for the country! So some botanists undertake a jurist's decisions without even legal training, and the result is quite as ludicrous.

CURRENT LITERATURE.

A Flora of Texas.

With the commencement of volume II, the contributions from the National Herbarium take on a new character. Hitherto we have had lists and catalogues of the plants of certain remote regions of our country, with here and there the descriptions of new species of plants; these have been valuable in their way, but in the present contribution we have not only everything a list would include, but in addition a complete manual, helpful alike to the botanical student who will find in it a guide and a stimulus, and to the older botanist who has hitherto been obliged to search through *Plantæ Wrightianæ*, *Plantæ Lindheimerianæ*, *Plantæ Fendlerianæ* and dozens of other papers for the information which this work presents in compact form.[1]

The present publication covers the Polypetalæ and is the forerunner of others which will present our present knowledge of the Flora of Western Texas, of whose vegetation so much remains to be known. The National Herbarium deserves the praise of all botanists for undertaking such a valuable project for making known the flora of remote regions. When this area is completed there are other regions that equally demand attention before the flora of our domain is thoroughly made known. On the other hand the botanical students of Texas are laid under deep obligations to the National Herbarium for furnishing a manual of their flora, and ought to be stimulated in the collection of material and notes that will assist in clearing up many problems in distribution that the present work necessarily leaves open questions.

The name of the author is a sufficient guaranty of excellence in the arrangement of the work. We note with pleasure a few minor points which indicate a progressive spirit: (1) The use of the metric system for all measurements. (2) The adoption of certain changes in nomenclature, recognized almost everywhere as necessary. (3) The change of some ordinal names, as *Violarieæ*, *Caryophylleæ*, *Onagrarieæ*, etc.

Space will not permit as full statistics of the Texas flora as would be interesting. The following comparisons are given to show contrasts of distribution and the richness of the flora in question:

ORDERS.	TEXAN FLORA.		CHAPMAN'S FLORA SO. STATES.		GRAY'S MANUAL (*6th Ed.*)	
	Genera.	*Species.*	*Genera.*	*Species.*	*Genera.*	*Species.*
Ranunculaceæ	7	21	11	54	22	76
Violarieæ	2	5	2	17	3	20
Malvaceæ	14	53	12	40	11	25
Leguminosæ	52	203	56	191	46	156
Onagrarieæ	6	38	8	45	7	44
Cucurbitaceæ	10	12	4	4	5	5
Cactaceæ	4	71	2	6	2	6

We shall await the completion of the work with great interest.—L. M. UNDERWOOD.

---

[1] COULTER, JOHN M.—Manual of the Phanerogams and Pteridophytes of Western Texas: Polypetalæ. Contrib. from U. S. Nat. Herb. ii. no. 1. 8vo. pp. 152. pl. 1. Washington: Government Printing office. 1891.

Work from a productive laboratory.

THREE PAPERS have recently appeared in the series of "Contributions from the Cryptogamic Laboratory of Harvard University," and reprinted from *Proc. Amer. Acad.*, 26. No. XIV is entitled "Preliminary notes on the species of Doassansia," by William Albert Setchell. This genus, growing upon aquatic hosts, is separated from all the other Entylomata by having a sorus invested with a cortex of sterile cells. The twelve species, three of which are new, are arranged under three subgenera. Two new genera are described, both closely related to Entyloma and Doassansia. The one, *Burrillia*, dedicated to Prof. T. J. Burrill, has a compact, solid sorus with little or no cortex, and is found on leaves of Sagittaria; the other, *Cornuella*, dedicated to Prof. Maxime Cornu, has a hollow sorus with no cortex, and grows on Lemna.

No. XV is "On the structure and development of Choreocolax Polysiphoniæ," by Herbert Maule Richards, and contains a double plate. After describing fully the structure and development of this obscure alga which is parasitic upon the common alga, Polysiphonia fastigiata, the author discusses its relationship to the rest of the Florideæ. It has heretofore been placed among the Gelidiaceæ, but Mr. Richards finds that the condition of the cystocarp places the plant in the order Chætangiaceæ.

No. XVI is entitled "On a Kephir-like yeast found in the United States," by Charles L. Mix. "Kephir" is a fermented milk of the Caucasus Mountains, and the yeast which causes this alcoholic fermentation of milk has been known, so far, in no other place. What are known as "Kephir-grains" are added to the milk to produce the fermentation. These grains when fresh are white, compact, elastic masses, enveloped by a slime, with a spherical or elliptical contour, and varying from 1 mm. to 5 cm. in diameter. Drying does not deprive them of life, and in this dried state they are kept for long periods, becoming dirty brown and hard as stone. The origin of these grains seems to be unknown, no wild form of yeast having been found from which they might have been cultivated. They are said to grow in little clumps or granules on peculiar bushes found on the mountains just beneath the snow line. In 1881 Edouard Kern published the first account of the Caucasian "Kephir." The grains are composed of yeast cells and bacteria embedded in a zoöglœa mass. Exposed to unfavorable conditions the bacteria cells grow out into Leptothrix threads, with spore formation, and Kern named this Kephir bacterium Dispora Caucasica, a new genus and species. The recent study of Mr. Mix was suggested by the receipt by Dr. Farlow of two sets of specimens, one from Ontario and the other from New Jersey, resembling the Kephir grains described by Kern. Mr. Mix has examined them thoroughly, both in their structure and effects on milk, and has come to the conclusion that they are the same as the Kephir grains of the Caucasus. The paper closes with a discussion of the theories of this Kephir fermentation.

Minor Notices.

DR. V. F. BROTHERUS AND TH. SÆLAN have published an enumeration of the mosses of the Kola peninsula of Lapland[1] together with a discussion of their distribution. The Kola peninsula lies between the White Sea and the Arctic Ocean, and is almost wholly north of the Arctic Circle. The enumeration of 309 species belonging to 72 genera indicates, therefore, a very rich moss-flora. The nomenclature follows Lindberg.

THE CHICAGO ACADEMY OF SCIENCES has been rather lethargic, but we are reminded of its existence by the recent publication of No. 1 of the Second Volume of its *Bulletin.* This is a "Flora of Cook Co., Ills., and a part of Lake Co., Ind.," by William K. Higley and Charles S. Raddin, and makes a pamphlet of 168 pages.

The list itself is preceded by a tribute to Henry Homes Babcock, who, twenty years ago, was Chicago's most indefatigable and zealous botanist, and the director of her ephemeral botanic garden. An account of the geology of Cook Co., and items regarding the forest trees, disappearance of species, localities of interest and statistics from the catalogue find a place in the introduction. The list includes 1336 species and varieties, of which 187 are introduced and the remainder native. The names used are those of Gray's Manual (6th ed.), with a few exceptions, though the authors "cannot entirely indorse the nomenclature." It is a pity that they did not use it throughout, since their use of it would not imply indorsement.

THE INVALUABLE "Host Index to the Fungi of the United States," by Dr. W. G. Farlow and A. B. Seymour is now completed by the publication of part III. (Cambridge, June, 1891). The present part contains the Endogens, Coniferæ, Cryptogams and Animals; followed by copious addenda, corrigenda and a full index. The 219 pages of the complete work represent an enormous amount of painstaking labor. We hope that the authors will have their reward in a large sale of the work. They may certainly take what reward there is in the consciousness of having done their fellow workers a most important service.

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[1] Musci Lapponiæ Kolaënsis. Extract from Acta Soc. pro Fauna et Flora Fennica, VI. 8vo. pp. 100, with map. Helsingfors, 1890.

OPEN LETTERS.

What name shall be used? What is an authority?

If a worker in the botanical vineyard who has neither right nor claim to the title of "Systematic Botanist," may be permitted to ask a question concerning the proper nomenclature of seed-plants, perhaps a little illumination may be graciously let into his unsystematic brain-box by some of those who not only claim the title, but wear it right royally. The question is a brief one:

If we are not to use the oldest attainable specific name for a plant, what specific name are we to use?

Certainly we can not use the "oldest binomial," for our notions of a genus, and its inclusions are constantly changing. Nor is it particularly helpful to suggest that the name sanctioned by "authority" is the proper one, for after all — and I speak with bated breath, as one treading on holy ground — who *is* this "authority" anyhow? Is it the first worker in a group or the last? Is it the dead or the living? Is it this institution or is it that? Or is it the consensus of workers along some line? I, for one, have always supposed that attempts to constitute one's self, or one's descendants, or one's co-workers a botanical, zoological, geological or petrographical hierarchy was, to say the least, unscientific. If great groups of humble workers — such as those who gain a little cheap notoriety by trying as best they may to get together a local flora in which the results of their best bibliographical and analytic ability are collected — are to be decapitated at one fell blow, it is important to have it understood just why they are disposed of and just who volunteers to pull the guillotine-lever.

There is such a constantly increasing number of young, misguided enthusiasts among the group which we may for convenience call the "botanists of North America," that something more than reading the riot-act will be necessary to convince them that, after all is said, the temper of Charles Darwin is not a pretty fair one to try to imitate. Consequently they will doubtless continue to struggle along, doing the best they can, differing from "the authority" when they honestly have to differ, submitting their efforts to the test of time and the correction of wider and abler research, receiving honest criticism with what grace human nature permits and, withal, meaning no affront, personal or otherwise, to the authorities with whom they cheaply differ.

On the whole this second question troubles the writer as well as the first. An answer is respectfully asked. "What *is* an authority?" — CONWAY MACMILLAN, *University of Minnesota.*

NOTES AND NEWS.

HENRI JUMELLE has, by three distinct lines of proof, shown that when in the light the absence of CO_2 accelerates the transpiration of green parts of plants, this acceleration is due to the fact that the energy of the rays absorbed by the chlorophyll is not employed for the decomposition of CO_2, but operates entirely in increasing transpiration.

PROFESSOR BYRON D. HALSTED has been elected secretary of Section F. of the A. A. A. S., for the meeting to be held next August in Rochester, N. Y.

MESSRS. F. H. KNOWLTON and THEO. HOLM, of the U. S. National Museum, sailed for Europe early this month for a two months visit both for science and pleasure.

A RESOLUTION recommending the establishment of a National Arboretum at Washington was approved by the Botanical Club, Section F, and the general Association.

DR. J. M. MACFARLANE, assistant in botany in the University of Edinburgh, was made welcome by the American botanists at the Washington meeting, and took an active part in the proceedings.

MR. THOMAS MEEHAN has found cleistogamous flowers in abundance on *Polygonum acre* and suspects the same habit in other species. He expects to make this the topic of a note in the Proceedings of the Philadelphia Academy.

PROFESSOR ANDREA KROSSNOFF, of the University of Charkoff, S. Russia, was present at the botanical meetings of the Association, and desired to make arrangements for the exchange of plants of the Caucasus and other Russian districts for the plants of central and western N. America.

THE BOTANICAL papers at Washington were so numerous that many well known botanists, who had intended to read, presented no papers. The feeling was strong in favor of a separate Section of Botany, and notice of an amendment to that effect was given, to be acted upon at the next meeting of the Association.

MR. O. F. COOK, instructor in biology at Syracuse University, is at the head of an expedition, to Liberia and other parts of Africa, which is to sail about Nov. 1. The object of the expedition is to study the natural history of the country, especially the plants and insects. Mr. Cook will be glad to hear from any persons who would like material from that region.

DR. C. F. MILLSPAUGH, Morgantown, W. Va., will issue a preliminary catalogue of the Flora of West Virginia the coming winter; with his own work in the State he is desirous of compiling that of others as fully as possible. Any botanists who have worked in the State, and who will send a list of species they noted there, giving localities, will receive full credit, and six copies of the Flora as return for the kindness.

MR. T. KING, of Wellington, New Zealand, who was formerly conservator of the state forests on those islands, is preparing sets of New Zealand plants of from 500 to 1000 species, which he will dispose of at $4.50 per hundred. Mr. King is the most prominent botanist of New Zealand, and author of "The Forest Flora of N. Z." and of a "Student's Manual of the Flora of N. Z." This is a good opportunity for any who may wish to secure plants from that region.

E. AUBERT finds a simultaneous evolution of O and CO_2 in certain Cactaceæ when the illumination is of moderate intensity and the temperature high (35° C.) The explanation seems to be that the respiration of the tissues is sufficiently active to produce more CO_2 than can be assimilated by the superficial chlorophyllous tissue. When the temperature is reduced to 10°-15°, or when the intensity of the light is increased, the CO_2 is not recognizable.—Cf. *Compt. Rend.* 112. 674.

BRAZIL IS to have an Agricultural and Mechanical College. A syndicate of capitalists has already secured a fund of $200,000 for its endowment, and the state and general governments will aid it. It is to be located in Sao Paulo, under the Tropic of Capricorn, in the best part of the Republic. Its promoters expect to make it the largest institution of the kind in existence. Professor L. H. Bailey has been tendered the presidency. The offer is a very flattering one, not only in a financial way, but also in the opportunity for work in a splendid flora.

A USEFUL SOUVENIR was presented to the botanists by the Forestry Division of the Department of Agriculture. It contained a list of the trees to be found in the various parks of Washington with maps that serve as a complete direction. The souvenir is a curiosity in the matter of synonymy; containing also the description of a new species, a single specimen of which is now growing on the grounds of the Agricultural Department, but whose nativity no one knows, it furthermore raises the question whether describing a plant in a souvenir is publication.

IN CONNECTION with Dr. Halsted's note (p. 266) on the influence of copper salts on germination, a recent paper of O. Loew [1] on the poisonous action of distilled water is of interest. Such an action has been observed in the case of several Algæ, notably Spirogyra. Nägeli determined that this was due to the traces (1 : 10,000,000) of copper derived from the distillation apparatus and presumably dissolved as carbonate. The poisonous action is not exerted by water distilled in glass vessels, nor after the distillation of the first 25 liter seven from metal apparatus.

PROFESSOR R. PIROTTA is writing a monograph of *Keteleeria Fortunei* Carr., a monotypic Conifer. In a preliminary note [2] he shows that the primary root is diarchous and contains a large pith, in the middle of which is a resiniferous duct of considerable size; similar ducts are also irregularly scattered in the secondary wood; besides that the secondary bark shows several mucilage-cells (*idioblasti muciparí*). In contrast to the root, the stem has resiniferons ducts and mucilage-cells in its primary bark and wood, but none in the secondary. The leaves have only stomates on their inferior face. The mesophyll shows three zones: a palisade tissue of two rows of perpendicular cells, a pneumatic tissue of about three rows of rather irregular cells, which form large lacunes, and finally an uncolored conductive tissue, surrounding the fibro-vasal bundles. Two resiniferous ducts and some very large, roundish mucilage-cells were observed in the leaves, especially distinct in tangential or longitudinal sections.—T. H.

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[1] Landw. Jahrb. 20. 235. (1891).

[2] Annuario del R. Instituto botanico di Roma, anno IV, 1891.

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VOL. XVI. OCTOBER, 1891. NO. 10.

THE
BOTANICAL GAZETTE

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[ISSUED OCTOBER 16.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

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A study of some anatomical characters of North American Gramineæ. III.

THEO. HOLM.

Distichlis and Pleuropogon.

(WITH PLATES XXIII AND XXIV.)

Distichlis maritima Rafinesque.— While engaged in studying the leaf-structure of *Uniola Palmeri* Vasey, I was well aware of the great similarity that exists between this species and the genus Distichlis in external characters of the inflorescence, the rhizome, and the rigid, densely 2-ranked, involute leaves. Now having examined the anatomy of the leaf of a number of specimens of Distichlis, the similarity between these two plants has been found to be so striking that it seems most natural to consider Uniola Palmeri as a true Distichlis. Professor F. Lamson-Scribner has also informed me that on seeing the plant, he immediately took it for a Distichlis and was unable to distinguish it from this genus.

In studying the leaf-structure of Distichlis maritima, several male and female individuals have been examined from different parts of North America, and although the structure is essentially the same, a few differences have been observed. If we take the entire structure of the leaf into consideration and compare it with that of the so-called Uniola Palmeri, described in the preceding paper, it will be difficult to find any essential difference. We may take for comparison the leaf of a female plant of D. maritima from western Texas of which a transverse section is figured on plate XXIII, fig. 1.

The epidermis of both faces shows the same structure as described for the superior face of Uniola Palmeri, having numerous warts and rather pointed epidermal expansions. The structure of the mestome-bundles is exactly the same and the development of these as well as their distribution accords perfectly with what we have seen in U. Palmeri, viz.: a thin-walled and green proper parenchyma-sheath, surrounding, at least in the largest bundles, a closed ring of very thick-walled parenchyma. Furthermore the leptome and hadrome are often separated by a layer of similar parenchyma, and groups of very thick-walled leptome-parenchyma are also observable in the strongest bundles. The stereome, the mesophyll and the uncolored parenchyma agree entirely with that of U. Palmeri. The leaf structure of a series of specimens of D. maritima, male and female, but from widely separated localities is here compared:

Arizona, ♀: The stereome is rather weakly developed and the blade is relatively broader.—California, ♀: Agrees in all details with the specimen from western Texas, described above.—New Jersey, ♀: Especially characterized by the very rough inferior face of the leaf, due to numerous warts. The stereome is very strongly developed above and below the mestome-bundles.—Montana, ♂: Differs from all the above mentioned female plants in having a closed ring of merely thin-walled parenchyma inside the proper sheath, and no thick-walled parenchyma either in the leptome or between this and the hadrome. The superior epidermis shows very long thorn-shaped and curved expansions.—Arizona, ♂: The superior epidermis shows short, thorn-shaped expansions, and long hairs, especially towards the base of the blade, situated among the bulliform cells. The inferior epidermis is on the contrary nearly smooth and without any hairs. The mestome-bundles show the same structure as described above for the female specimen, and the groups of stereome are strongly marked.—Washington, ♂: Both faces of the leaf are very rough, and the stereome shows an exceedingly strong development. There is a closed ring of very thick-walled parenchyma inside the proper sheath of the largest mestome-bundles, and the leptome is nearly divided into two separate groups by similar cells.—Vancouver Island, ♂: This specimen is well characterized from the preceding in having merely a horse-shoe-shaped layer of thick-walled parenchyma on the leptome side.—Montana, ♂ (alkaline soil): This specimen, compared with that described above from the same locality, but not from the same kind of soil, shows a remarkable difference in having a layer of very thick-walled parenchyma inside the proper sheath. Groups of similar cells are scattered in the leptome and a layer separating it from the hadrome. The superior epidermis has warts, but no long thorns, and the inferior one is nearly smooth with only a few projecting warts.

D. maritima Raf., var. *stricta*, ♂ from Nebraska: This form is especially characterized anatomically by the hairy and rough epidermis of the superior face of the blade, where numerous thorn-shaped expansions are intermixed with conical warts. The stereome is rather strongly developed, while the mestome-bundles, the mesophyll, etc., agree with what has been mentioned above for the typical form.

D. maritima Raf., var. *laxa*, ♀ from Utah: The epidermis of the leaf is nearly smooth on both faces, being destitute of hairs and thorn-shaped expansions; otherwise it agrees perfectly with the preceding variety.

D. thalassica Humb. et Kth., ♂ from Lower California: The leaf of this species shows the same structure in most details as the preceding D. maritima. It is, however, quite well characterized by the very rough epidermis, of which that of the superior face shows several sharp-pointed expansions, while that of the inferior face has numerous conical warts. The largest mestome-bundles have a closed ring of thick-walled parenchyma inside the proper sheath, and the leptome contains groups of similar cells, by which it is also separated from the hadrome. The stereome represents groups of considerable size above and below the largest mestome-bundles, but is entirely wanting below the smallest ones.

D. prostrata Benth., ♂ from Mexico: The leaves are rough above, hairy below and along the margins; the epidermal expansions of the superior face are thorn-shaped, while those of the inferior are merely warts or soft hairs. The mestome-parenchyma does not show such thick-walled cells as described for the preceding species, and the leptome is but imperfectly separated from the hadrome. As to the stereome, this forms merely small groups above and below the strongest mestome-bundles, and the uncolored parenchyma is only represented by small groups between the bulliform cells and the inferior epidermis. Considered altogether the anatomical structure of the leaf in the genus Distichlis is very uniform, and it does not seem possible to give any special characters, by which either the varieties or the supposed species thalassica and prostrata may be distinguished from the species maritima; because we have seen that male and female specimens of this last show variations among themselves nearly equivalent with the differences in the two varieties and subspecies.

Of the genus *Pleuropogon*, which is closely related to Uniola and Distichlis, three species are known. Two of these, *P. refractum* Gr. and *P. Californicum* (Nees), are inhabitants of

California, while the third one, *P. Sabinei* R. Brown, is a high arctic type. Specimens of this were collected at Cape York in northwestern Greenland by the Swedish paleontologist Nathorst, who has kindly furnished me with several finely preserved individuals.

The leaf structure shows in these species a rather uniform aspect, which strikingly indicates their occurrence in wet meadows, although they live under such widely different climatological conditions. Very characteristic are the large lacunes in the mesophyll, the merely two groups of bulliform-cells in the carene, and the proportionally weak development of the stereome.

Pleuropogon refractum Gr.—The epidermis cells are rectangular with nearly straight and rather thin walls and there are on both faces of the leaf numerous conical warts. The superior face shows also several thick-walled and sharp-pointed expansions, which are directed upwards and which form long lines above the stereome-bundles (plate XXIV, fig. 9). Stomates are present on both faces of the leaf and are partly surmounted by conical warts. The bulliform cells form two groups, one at each side of the midrib ; they are large and their exterior walls are entirely smooth in contrast to the other cells of the epidermis (plate XXIV, fig. 8).

The mestome-bundles represent two degrees of development; the median one (plate XXIII, fig. 6) is the largest in the whole blade and forms a slightly prominent carene. It is surrounded by a thin-walled parenchyma-sheath of which a part contains chlorophyll. Inside this, the proper sheath, is also to be observed a true mestome-sheath, the cells of which are somewhat thickened. The leptome is separated from the hadrome by a single stratum of thick-walled mestome-parenchyma, and there is a small group of stereome above and below the entire bundle. As to the corresponding mestome-bundles in the lateral parts of the blade, these differ from the median one merely by having a few cells of uncolored parenchyma on both faces, so that the stereome is not here in contact with the parenchyma-sheath. A small mestome-bundle, representing the second degree, has been figured on plate XXIII, fig. 7, where is a completely uncolored parenchyma-sheath with a thin-walled mestome-sheath inside this. The leptome and hadrome are not so strongly developed as in the preceding and they are not separated from each other by thick-walled parenchyma. The stereome shows here but small groups and is often wanting on the inferior face, below the leptome. The uncolored parenchyma consists here of one or two cells on the hadrome side.

Concerning the distribution of these two forms of mestome-bundles it may only be said, that the smallest ones are prevalent in the whole blade. As indicated above, the stereome is rather weakly developed, and forms groups corresponding to the mestome-bundles. There are, however, besides these groups some isolated ones (plate XXIV, fig. 8) opposite the bulliform cells, and also above the middle of the lacunes on the superior face, besides one at each of the two margins of the blade. The mesophyll is strongest in the middle part of the blade, where it forms one large group on each side of the midrib; in the lateral parts of the blade it is interrupted by the large lacunes, which extend from the one mestome-bundle to the next one. The uncolored parenchyma is in the mature leaf restricted to small groups, corresponding to the mestome-bundles, as described above.

Pleuropogon Californicum (Nees.)—Plate XXIII, fig. 4, a transverse section of the middle part of the blade, shows a remarkable difference from the preceding species. There is a sharp carene on the superior face, a structure undoubtedly very rare in the Gramineæ. Otherwise the section reminds one very much of that of P. refractum.

The epidermis of the superior face consists of rectangular, thin-walled cells with slightly undulated side-walls, especially above the nerves. Wart-shaped expansions are numerous, although wanting above the large bulliform cells, and there are also some lines of thorn-shaped expansions in this species above the nerves. The stomates, which are equally distributed on both faces of the blade, are surrounded, not surmounted as in the preceding species, by warts. The epidermis of the inferior face differs in the presence of dwarf-cells in alternation with longer, rectangular ones, all showing distinctly undulated side-walls. Epidermal expansions are on this face merely warts, which form longitudinal lines below the stereome-bundles or sometimes also between these.

As to the mestome-bundles, these are also here, representing two degrees, of which the first one may be described from the median (plate XXIII, fig. 5). The parenchyma-sheath is uncolored and thin-walled, bordered above and below by one or two similar uncolored cells. There is a distinct mestome-sheath, the walls of which are especially thickened inwards. The leptome and hadrome are separated from each other by two strata of thick-walled parenchymatic cells. These large bundles are supported by groups of stereome above and below, which are separated from the parenchyma-sheath by a few uncolored cells, excepting in the median one, where the mesophyll forms an uninterrupted group above the entire bundle. The mestome bundles of second degree differ in size from those of first degree ; besides which the mestome-sheath shows merely thin-walled cells, and the leptome is in immediate contact with the hadrome.

The stereome agrees very well with that of P. refractum, but the number of isolated groups is larger here, there being three groups opposite the bulliform cells, one below and about three above the lacunes. The mesophyll and the uncolored parenchyma correspond in most details with those of the preceding species.

Pleuropogon Sabinei R. Brown.—Epidermis of the superior face consists of thin-walled, rectangular cells with nearly straight side walls, and there are numerous conical warts. The stomates are restricted to this face and are surmounted by conical expansions of the surrounding epidermis cells. The inferior face of the blade is entirely smooth ; the cells show strongly undulated side-walls and are nearly equal in size.

A transverse section of half of the blade shows about the same structure as in P. Californicum with the sharp keel on the superior face. The mestome-bundles are also nearly the same, but it must be remarked, that in this species the mestome-sheath is merely thin-walled in both forms of bundles; besides which the leptome and hadrome are but imperfectly separated in the largest ones by a few not very thick-walled parenchymatic cells.

The stereome shows in this species a still smaller development than has been observed in the two other species, and forms here merely two isolated groups in the margins of the blade. The mesophyll and the uncolored parenchyma agree in all the details with the corresponding tissues of P. Californicum.

Considering now these three species of Pleuropogon together, it is evident that they are, in spite of their great similarity, easily distinguished from each other by the following anatomical characters, taken from the leaf-blade:

Epidermis.

Thorn-shaped expansions on the superior face	P. refractum. P. Californicum.
Epidermis of the inferior face perfectly smooth...........	P. Sabinei.
Epidermis of the inferior face with dwarf cells in alternation with long, rectangular ones........................	P. Californicum.
Stomates present on both faces..........................	P. refractum. P. Californicum.
Stomates present merely on the superior face.............	P. Sabinei.
Stomates surmounted with warts	P. refractum. P. Sabinei.

Mestome-bundles.

Midrib forming a sharp carene on the superior face of the blade :..	P. Californicum. P. Sabinei.
Mestome-sheath thick-walled in the largest bundles	P. refractum. P. Californicum.
Leptome and hadrome separated in the largest bundles....	P. refractum. P. Californicum.
A few not very thick-walled cells between the leptome and hadrome of the largest bundles........................	P. Sabinei.

Mesophyll.

Forms two separate groups, one on each side of the midrib	P. refractum.

Stereome.

One isolated group opposite each of the two groups of bulliform cells	P. refractum.
Three isolated groups opposite each of the two groups of bulliform cells......................................	P. Californicum.
One isolated group above each lacune.....................	P. refractum.
One isolated group below and three above each lacune.....	P. Californicum.

Lacunes.

Bordering on the parenchyma-sheath of the mestome-bundles	P. refractum.
Separated from the parenchyma-sheath by a small layer of mesophyll	P. Californicum. P. Sabinei.

U. S. National Museum, Washington, D. C.

EXPLANATION OF PLATES XXIII AND XXIV.

Figs. 1–3, *Distichlis maritima*, ♀.—Fig. 1. Transverse section of half of the leaf. The black part of the figure represents the mesophyll, × 75.—Fig. 2. Transverse section through the midrib, × 560.—Fig. 3. Transverse section through a small mestome-bundle, × 560.

Figs. 4–5. *Pleuropogon Californicum.*—Fig. 4. Transverse section of the middle part of the blade, × 75.—Fig. 5. Transverse section through the midrib, × 560.

Figs. 6–9. *Pleuropogon refractum.*—Fig. 6. Transverse section through midrib, × 560.—Fig. 7. Transverse section through small mestome-bundle, ×560.—Fig. 8. Transverse section of the middle part of the blade, ×75.—Fig. 9. Epidermis of the superior face, × 240.

Figs. 10–12. *Pleuropogon Sabinei.*—Fig. 10. Transverse section of half of blade, × 75.—Fig. 11. Transverse section through midrib, × 560.—Fig. 12. Transverse section through a small bundle, × 560.

On the structure and dimorphism of Hypocrea tuberiformis.

GEO. F. ATKINSON.

(WITH PLATE XXV.)

Hypocrea tuberiformis was described as follows by Berkeley in Grevillea IV, p. 13, from specimens collected by Ravenel in South Carolina: "Magna tuberiformis mycelio radiata albo affixa. On stems of *Arundinaria*. Car. Inf. Ravenel. No. 1220. Forming either a large mass ¾ of an inch across, or two or three distinct subglobose individuals, fixed to the stem by a radiating white rugose mycelium; at first yellowish, then black."

It was also distributed in Rav. F. Am. n. 733, and in Rav. Fung. Car. n. 52. Most of the specimens collected by Ravenel were probably sterile, since there is, to my knowledge, no published description of the forms of this dimorphic fungus.

Saccardo (Sylloge Fungorum II, p. 534) repeats Berkeley's description. Ellis and Everhart (Journal of Mycology II, p. 68) place it in the group of *Hypocreaceæ*, which constitutes Saccardo's genus *Hypocrella*, and add the following note, probably taken from specimens distributed by Ravenel: "Apparently the original specimens were imperfect and, as those in Rav. F. Am. are either young or sterile, we can only say that the perithecia are subcylindrical and stand on the stroma like the young horns of *Podisoma macropus*, about one millim. high."

Patouillard (Bull. de la Société Mycologique de France, VI, 2e fasc. pp. 107–9, 1890) describes a new genus of Hypocreaceæ under the name Dussiella. The perfect condition of the fungus he examined was deposited in the Berlin Museum and collected on stems of Arundinaria at Caracas, the conidial stage from specimens collected by Duss in Martinique. He considers these forms to be the conidial and ascosporous stages of *Hypocrea tuberiformis* B. & R., but unquestionably it is a very distinct fungus from the one described by Berkeley, from Ravenel's collection.

The perithecia are entirely immersed in the stroma, paraphyses are present, and while, as he states, the linear ascospores show its relationship to *Epichloe* and *Hypocrella*, the peculiar structure of the apex of the asci in *Epichloe* and *Hypocrella* is not present in his specimens, or at least not represented in the illustration. I first collected sterile forms of *Hypocrea tuberiformis* B. & R. on Arundinaria at Columbia, S. C., during the winter of 1888–1889. During the last two years I have collected at Auburn, Ala., its sphacelia and ascigerous stages.

STROMA.— The stroma is subglobose, entire, lobed, or divided, seated upon the reed or upon the leaf sheath and fastened by a whitish mycelium, consisting of radiating, undulate threads, which sometimes become tinged with yellowish brown. It consists of two different strata when young, composed of slender, compactly interwoven hyphæ. The outer stratum is quite opaque, as shown in section, and yellowish. It is connected with the inner white stratum by loose threads. The whole is of a leathery or corky consistence. When mature a section shows three differently colored strata; an inner layer, white, which is sometimes tinged with pink; an intermediate layer, light ochre; and an outer layer, cinnamon. The intermediate layer is not quite so compact as the outer two. After the stroma is dead it sometimes becomes black.

SPHACELIA STAGE. — The sphacelia stage occurs at Auburn, Ala., in late spring. I first collected it May 10, 1890. The conidiphores radiate from the surface, which they thickly cover, and are needle-shaped, tapering gradually to a sharp point where the conidia are borne. They measure $35–40\mu$ long by $2–3\mu$ at the base. The conidia are oval or broadly fusoid, inequilateral, hyaline, mostly continuous, but the larger ones sometimes faintly one-septate. Size, $3.5–4 \times 7–10\mu$.

ASCIGEROUS STAGE.[1] — The perithecia are sessile, or only the rounded base immersed in the superficial part of the stroma. They are subcylindrical, a little broader in the middle than at each end, floccose, with loose white threads through which the cinnamon color shows. The apex is smooth and resembles the apex of *Epichloe typhina* (Pers.) Tul. The ostiolum is distinct. They are about 1 millimeter long by one-third of a millimeter in diameter, and stand on the stroma singly or in groups of 3–4–20, or crowded over a large portion. They are frequently branched, the bases of two, three or more being joined and the cavities confluent below.

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[1] Mature in August and September.

The asci are 8-spored, very large, varying from 450-750× 14μ, tapering to a slender point at base, more gradually toward the truncated apex. They are very stout at the apex, somewhat like those of *Epichloe typhina* (Pers.) Tul. and *Hypocrella atramentosa* (B. & C.) the end being slightly enlarged, conoid and truncate.

The ascospores are linear, hyaline, pluriguttulate and pluriseptate, rounded at each end, at maturity separating at the septa and frequently germinating while yet within the perithecia, the germ tubes arising from any of the segments, sometimes before the sporidia separate at the septa. In most of the asci there is indication of a narrow slit through the apex, represented by a dark line, but I have never seen the spores escape through it. I have observed the same thing in the asci of *Epichloe typhina* (Pers.) Tul., but have not been able to determine positively whether it is a slit or only an opaque line.

We are able to see from this study the affinity of *Hypocrea tuberiformis*, B. & R., with Epichloe, since its only disagreement lies in the fact that the stroma of Epichloe, as characterized, entirely surrounds the stem of its host, while those agreeing in all essential parts of structure, but only partially surrounding their hosts, are provided for in Saccardo's genus Hypocrella. It thus frequently transpires that the genetic relationship of some forms is determined by fortuitous circumstances rather than by structural affinity.

Hypocrea atramentosa B. & C. might have been an *Epichloe* were it not for the fact that it appears too early in the season upon the opening buds of *Andropogon Virginicus*. These it first entirely embraces with its infant stroma, when later Andropogon rises, tears it asunder, bears it only upon the underside of the leaves in the cluster, and leaves it nothing but a Hypocrella! But, until a monographic study can be made of members of both genera, *Hypocrea tuberiformis*, B. & R. should read, *Hypocrella tuberiformis* (B. & R.) My specimens were collected on *Arundinaria macrosperma* Michx. var. *suffruticosa* Munro (*Arundinaria tecta* Muhl.)

I take this opportunity of noting the favor extended by Mr. B. T. Galloway, Chief of the Division of Vegetable Pathology, Washington, D. C., in allowing me the use of the Bull. de la Soc. Myc. de France, *tom. cit.* and Ravenel's two exsiccati, Fung. Am. and Fung. Car. I find that n. 52 of the latter is a perfect condition of this fungus.

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EXPLANATION OF PLATE XXV.—*Hypocrella tuberiformis* (B. and R.) Atkinson. Fig. 1, section of portion of young stroma; *a* inner layer; *b* outer layer: *c* conidiophores. Fig. 2, conidia. Fig. 3, ascus with linear ascospores. Fig. 4, portion of ascospore germinating. Fig. 5, perfect condition, stroma bearing perithecia. Fig. 6, section of stroma. Figures 5 and 6 are magnified about 1½ times, the other figures much more.

Notes on the Flora of Canada.

JAMES M. MACOUN.

During the season of 1890 a considerable number of plants were discovered in various parts of Canada that were either new to the Dominion or were of sufficiently rare occurrence to be worthy of note. Except when otherwise mentioned all the plants in this list were collected by Prof. Macoun and myself in British Columbia. The asterisk (*) after the name of a plant signifies that it had not before been found in Canada.

1. Thalictrum Fendleri ENGELM.*—Very abundant in low grounds at Kicking Horse Lake, Rocky Mts.

2. Ranunculus hispidus MX. var. Oreganus GRAY.*—Low grounds at Sproat, on the Columbia River, 15 miles north of the International Boundary, and on the Kootenay river, about half way between Sproat and Kootenay lake, B. C.

3. Ranunculus hederaceus L.*—Marshes near New Harbour, Newfoundland. Collected by Rev. A. C. Waghorne in 1889 and 1890.

4. Isopyrum biternatum TORR. & GR.*—Abundant in the vicinity of London, Ontario. Collected by J. Dearness.

5. Delphinium simplex DOUGL.—Very abundant on rocky banks, about 2 miles above the junction of the Kootenay and Columbia rivers, B. C.

6. Papaver nudicaule L. var. arcticum, ELKAN.—One clump of about twenty specimens was found on the mountains at Kicking Horse Lake, Rocky Mts., at an elevation of 8,000 feet.

7. Cardamine bellidifolia L.— Three specimens of this minute species were found growing with *Draba alpina* in mud on the western slope of Avalanche Mt., Selkirk Mts., B. C., altitude 7,500 feet. Not collected in Canada since Drummond's time.

8. Arabis Macounii WATS.—A new Arabis that has been named as above by Dr. Watson, and has lately been described, grows in abundance on gravelly slopes, west of the Columbia River at Revelstoke, B. C.

9. Draba nivalis JACQ. var. elongata WATS.—A few specimens of this plant were collected on the mountains at Kicking Horse Lake last season, where it had been found in 1885, but not separated from *Draba stellata* Jacq., with which it was growing.

10. Thysanocarpus pusillus HOOK.—Gravelly slopes at Sproat, B. C. Not recorded from interior before.

11. Silene Macounii WATS.— Dr. Watson has recently separated this species from S. multicaulis, and all Rocky Mountain references in Macoun's Cat. of Can. Plants belong to this species. Not rare on the mountains at Rogers' Pass and Kicking Horse Lake.

12. Arenaria tenella NUTT.—On dry ground at Kamloops, B. C. Not collected before in interior.

13. Stellaria longipes GOLDIE, var. Edwardsii T. & G.— Not rare on mountains at Kicking Horse Lake, Rocky Mts. Not recorded before from western Canada.

14. Sidalcea malvæflora GRAY.—Common at Revelstoke, B. C. Not recorded before from interior.

15 Claytonia cordifolia WATS.*— Abundant in woods (5,000 feet alt.) at "Warm Springs," Kootenay Lake, B. C.

16. Trifolium involucratum WILLD.— Revelstoke, B. C. Not found in interior before.

17. Trifolium microcephalum PURSH.— Revelstoke and Sproat, B. C. Not found in interior before.

18. Fragaria Virginiana DUCH. var. Illinoensis GRAY.— The common form at Deer Park, Lower Arrow Lake and Toad Mt., B. C.

19. Epilobium clavatum TREL.—A few specimens were found on mountains at Kicking Horse Lake, at an altitude of 7,000 feet.

20. Peucedanum bicolor WATS.*— Hillsides at Sproat, B. C.

21. Zizia cordata KOCH.—Rare at Kicking Horse Lake, Rocky Mts. The western limit in Canada.

22. Ligusticum scopulorum GRAY.*—Specimens collected at Rogers' Pass, B. C., have been doubtfully referred here by Prof. Coulter.

23. Angelica Lyallii WATS.*—In subalpine woods at Sproat, B. C.

24. Cornus pubescens NUTT. var. Californica, C. & E.*—Common at Sproat and Revelstoke, B. C.

25. Aplopappus Lyallii GRAY.*—With A. Brandegei on mountains at Kicking Horse Lake, altitude 8,000 feet.

26. Aster stenomeres GRAY.*—Amongst rocks on mountains at Sproat, B. C.

27. Antennaria luzuloides T. & G..—Deer Park, Lower Arrow Lake. Rare in Canada.

28. Gnaphalium decurrens SPRENG. var. Californicum GRAY.*—Rare at Revelstoke, B. C.

29. Hemizonella Durandi GRAY.*—On hillsides at Sproat, B. C.

30. Madia glomerata HOOK.—Revelstoke, B. C. Western limit in Canada.

31. Madia sativa MOL. var. racemosa GRAY.*—Near Sproat, B. C. Eastern limit in Canada.

32. Arnica Parryi GRAY.*—Mountain slopes at Kicking Horse Lake, Rocky Mts.

33. Arnica latifolia var. viscidula GRAY.*—Wooded slopes at Rogers' Pass, Selkirk Mts., B. C.

34. Arnica cordifolia var. eradiata GRAY.*—Woods at Deer Park, Lower Arrow Lake, B. C.

35. Microseris nutans GRAY.*—Common at Sproat, B. C.

36. Crepis runcinata T. & G.—Revelstoke, B. C. Western limit.

37. Heterocodon rariflorum NUTT.—Sproat, B. C. Eastern limit.

38. Micromeria Douglasii BENTH.—"Hot Springs," Kootenay Lake, B. C. Northern and Eastern limit in Canada.

39. Eriogonum niveum DOUGL.*—Lake Okanagon, B. C. Collected by J. McEvoy.

40. Asarum caudatum LINDL.—Revelstoke, B. C. Eastern limit in Canada.

41. Epipactis Helleborine CRANTZ.*—Near Lambton Mills, Ont. Collected by W. and O. White.

42. Epipactis gigantea DOUGL.—Deer Park, Lower Arrow Lake and "Hot Springs,"Kootenay Lake, B. C. Rare in Canada.

43. Allium Nevii WATS.—Lytton, B. C. Collected by Jas. McEvoy. Only found before in Canada on Vancouver Island.

44. Potamogeton crispus L.*—Ashbridge's Bay, east of Toronto, Ont. Collected by Wm. Scott.

45. Carex Tolmiei BOOTT, var. nigella BAILEY.*—Mts. at Kicking Horse Lake, Rocky Mts.

46. Carex marcida BOOTT, var. debilis BAILEY.*—Kicking Horse Lake, Rocky Mts.

47. Agrostis geminata, TRIN.*—Rogers' Pass, Selkirk Mts.

48. Agrostis alpina.*—Rogers' Pass, Selkirk Mts., B. C.

49. Alopecurus geniculatus L. var. robustus VASEY, (n. var.) Kicking Horse Lake, Rocky Mts.

50. Deyeuxia glomerata VASEY, (n. sp.)—Kicking Horse Lake, Rocky Mts.

51. Deyeuxia Canadensis HOOK. var. occidentalis VASEY.* Kicking Horse Lake, Rocky Mts.

Ottawa, Canada.

What the station botanists are doing.

BYRON D. HALSTED.

The present season is one of unusual activity among station botanists. At the risk of repetition I record briefly the leading points obtained by the several workers and in the alphabetical order of their names:

ALWOOD, of Virginia, has demonstrated an effective treatment for a leaf blight of the apple and established the fact that weak Bordeaux preparations are as effective for grape rot as stronger ones. He has been successful in the artificial pollination of wheat.

ARTHUR, of Indiana, has shown that the water for killing smut spores in soaking wheat can be heated to a considerably higher temperature than heretofore thought safe, and that this treatment, while effective in destroying the smut spores, much increases the yield of the grain. He has shown that the copper sulphate method is effective with oats but detrimental to the yield, and that the hot water method is equally effective. Results in the method of preparing seed potatoes have been obtained that may materially modify the customary ways of planting.

ATKINSON, of Alabama, has considered the fungous diseases of the cotton, describing some new species and recommending methods of treatment. He finds *Colletotrichum gossypii* South. on leaves and stems of cotton as well as the bolls; notes great injury to the fig by *Uredo Fici*, with suggestions as to spraying the tree to prevent it, and records for the first time in the United States the *Cercospora Bolleana* on leaves of the fig. He describes the nature of "Frenching" in cotton and shows that it is due to a fungus—a species of *Fusarium*. Critical notes have been published upon Erysipheæ of the Carolinas and Alabama, including the new species, *Microsphæra calocladophora* on *Quercus aquatica*.

BEAL, of Michigan, continues his experiments on grasses and clovers, that were planned several years ago.

BESSEY, of Nebraska, has investigated the natural forestry of the state and will soon publish the results. He is continuing his study of the forage problem of the plains.

BURRILL, of Illinois, has determined practical methods of exterminating Canada thistles. These pests do not seed in the rich prairie soil, but spread by rootstocks. Excellent results have been obtained with copper compounds as fungicides for grape rot, apple scab and potato blight. The latter is demonstrated to be a bacterial disease. A serious trouble of the blackberry and raspberry he has traced to the twig blight of pears (*Micrococcus amylovorus*). Studies are in progress upon several other bacterial diseases. *Puccinia rubigovera* has been found living over winter in the leaves of wheat and producing rust spores in early spring which grow upon the fresh foliage.

CHESTER, of Delaware, while confining himself almost exclusively to treatment of fungous diseases, has, in connection with the chemist, reached important conclusions as to the preparation of fungicides; e. g., in the use of carbonate of ammonia instead of aqua ammonia; the employment of glue and the use of a double hyposulphate of copper. It is now too early to report upon many field experiments. A study has been made of leaf spot of alfalfa, wheat scab, and rot of scarlet clover.

CRANDALL, of Colorado, is making a flora of the state, paying particular attention to the native grasses and fruits, and diseases of cultivated crops.

DETMERS, of Ohio, is studying the life history of the blackberry and raspberry, apple scab and potato blight, and the value of various fungicides. A state herbarium is being made.

DUDLEY, of New York, has found that the clover rust, prevalent from New England to the Sierras, is chiefly propagated in the uredo form, and is carried over the winter as mycelium. It was demonstrated that the æcidiospores produce uredo spots, and therefore the *Æcidium Trifolium-repentis* and *Uromyces Trifolii* are stages of the same species. The rust spores germinate best at a low temperature. As the second crop is most frequently infested, and as this is a valuable fertilizer, it often may be well to plow it under. The ordinary spores of the quince blight (*Entomosporium maculatum*) winter on the fallen leaves, not on the tree, so that germinating in early spring they infect the host directly. Therefore all leaves should be burned in autumn.

GARMAN, of Kentucky, shows that Bordeaux mixture and eau celeste will check the strawberry blight. Salt and lime may be used to prevent the growth of the broom rape, but will injure the host plant. Blue stone is satisfactory except its expensiveness. Hot water may be used to kill the broom rape seed, while doing no injury to, but rather benefiting, the hemp seed. Broom rape seed will retain its vitality in the soil for at least ten years. Anthracnose of the grape can be controlled by using blue stone 6½ lbs., lime 3½ lbs. to 22 gallons of water.

HALSTED, of New Jersey, is studying sweet potato and egg-plant diseases in particular, and looking after weeds in a general way.

HARVEY, of Maine, in his tests for germination of seeds, finds that a solution of corrosive sublimate of a proper strength to destroy the germs of mould, will injure the vitality of the treated seed. Fungicides and weeds are receiving attention.

HUMPHREY, of Massachusetts, has found the true pycnidial form of the black knot fungus, identified the "damping off" fungus with that causing the same trouble in Europe, added new facts concerning the scab of potatoes, the Peronosporeæ of the cucumber and the hibernation of cherry rot.

JONES (L. R.), of Vermont, during this his first year, is experimenting with fungicides upon potato rot, apple scab and rust, and oat and corn smut, but it is too soon for a report of results.

KELLERMAN, of Kansas, is moving to Ohio, but his work upon smuts and breeding of corn will remain as fine examples of his many important investigations beyond the Missouri.

LAMSON, of New Hampshire, writes that his work in the station for the year consists in collecting grasses, weeds and weed seeds, and of beginning in mycology and bacteriology.

MCCARTHY, of North Carolina, besides preparing a hundred page bulletin upon best agricultural grasses, has given much attention to field experiments with fungicides. The Burgundy mixture with soap is superior to the Bordeaux and the latter is improved by adding a small amount of glue. Seed testing is continued in co-operation with other stations.

MILL, of Alabama, has made a microscopic study of the cotton plant and is endeavoring to improve its fiber and seed by crossing. The effect upon lumber of tapping for rosin is being investigated. Wild grasses for grazing purposes and weeds are receiving attention.

SCRIBNER, of Tennessee, has a report ready for the press upon the grasses of the state. The work upon fungous diseases is being continued.

TRACY, of Mississippi, is engaged upon a flora of the state, is deeply interested in grasses and the blight of the tomato.

THAXTER, of Connecticut, it is with regret I note, has retired from distinctively station work, after doing excellent service in economic mycology. The results of his study of the onion smut, potato scab, apple rust and other fungous enemies, and means of controlling them, will be of permanent value. Dr. Sturgis succeeds him at New Haven.

BUCKHOUT, of Pennsylvania, and some others have a full load of college work.

BOLLEY, of North Dakota, and WOONTON, of New Mexico, are busy in their new fields.

New Brunswick, N. J.

BRIEFER ARTICLES.

A neglected Spartina.— During the past two or three years I have received from Florida, Mississippi and Texas, specimens of a Spartina which I was at first disposed to consider new, but which I now think is *S. junciformis* ENGELM. & GRAY, described in the *Boston Journal of Natural History* v. (1845) p. 238. It is evidently the S. gracilis of Chapman's Flora, but not at all the true *S. gracilis* TRIN. (not Hooker), which is well described by Mr. Watson in the Botany of the Fortieth Parallel as having "4 to 10 spikes, mostly sessile and appressed to the rachis, with the glumes and lower palet (floral glume) ciliate-hispid on the keel." It is a species of the Rocky Mountain region and the Pacific coast. The S. junciformis seems to be confined to the Gulf region, and may be described as follows:

Culms stout, smooth, 3 to 4 feet high; leaves involute, those of the radical tufts 1 to 2 feet long, those of the culm 5 or 6, generally involute, rigid, narrow, smooth, the lower 1 foot long, the upper shorter; ligule a very short hairy fringe, lower sheaths mostly shorter than the internodes, the upper longer; panicle spike-like, 5 to 10 inches long, dense, often cylindrical, tapering at the apex, composed of 30 to 50 or more sessile, imbricated, appressed spikes or branches, which are from ½ inch to 1 inch long at the apex, the lower ones longer and less dense; spikelets 2½ to a little over 3 lines long, the upper empty glume a little longer than the floral glume, the lower one ¼ or ⅓ shorter, both hispid on the keel, both very shortly mucronate, or sometimes without the mucro; floral glume slightly hispid on the back, obtuse; palet smooth about equaling its glume.

Florida, *J. H. Simpson;* Mississippi, *Prof. S. M. Tracy;* Texas, *G. C. Nealley.* Probably confined to the vicinity of the Gulf of Mexico.

Prof. Scribner, to whom I sent specimens of this Spartina, states that the same was collected last year by Mr. Pringle in Mexico, and that he identified it as *S. densiflora* BRONG. which is a native of Chili. He also states that *S. Gouini* FOURN., Mex. Pl. Enum. Gram. p. 135. is apparently the same. It may be doubted whether the Chilian species is the same as our plant; perhaps only an inspection of specimens will enable us to determine; but if Fournier's plant is the same, his name must give place to that of Engelmann and Gray, as that was published many years earlier.— GEO. VASEY, *Dep't of Agriculture, Washington, D. C.*

EDITORIAL.

THE GENERAL ignorance regarding the essential processes of plant life is appalling. If one were to ask the persons he met in a walk what trees lived on and how they secured their food, the answers received would doubtless be more curious than edifying. It would probably be a safe venture to assert that not one college graduate in one hundred can give a clear statement of vegetable nutrition, assimilation and respiration. And yet the college graduate has doubtless had the best opportunity of any class of persons to become informed upon subjects like these. The fact is that some of the most generally interesting topics relating to plants, those which bring plants into a more intimate relation with animals as living, active beings, have not yet received due recognition from general educators, or even from botanical teachers themselves. No one can accuse American botanists of being slow or of lack of enthusiasm, but having been absorbed in assorting the rich material of the native flora, in working out the life histories of the lower forms, and in studying minute structures by the newly developed staining and embedding methods, there has seemed to be no room and time for the consideration of other topics. But no one who has watched the course of the science elsewhere, or even at home, can doubt that the day for physiology to be the dominant subject in American botanical thought is not far off. When that day arrives, we may expect it to be more absorbing and more revolutionary of previous ways of thinking, than any of the recent waves that have disturbed the even tenor of botanical progress. It is to be hoped, indeed, that, besides the changes which may be effected in the course of thought within the botanical domain, this wave may be sufficiently powerful to beat high upon the rock bound coast of popular ignorance. Such a change in sentiment might give the opportunity to establish a new set of ideas regarding matters of physiology.

CURRENT LITERATURE.

Recent Systematic Papers.

CONTRIBUTIONS FROM THE NATIONAL HERBARIUM.— The first volume of this series of contributions is continued by the appearance of no. 4, issued June 30, 1891. It is the work of Mr. J. N. Rose, Assistant Botanist, and treats of the collections of plants made by Dr. Edward Palmer, in 1890, in western Mexico and Arizona. The collection from Alamos and vicinity proved to be a very rich one, no less than 45 new species being described in the paper. Ten of them are illustrated by full page or large folded plates. A new genus of Leguminosæ, *Willardia*, is proposed for a species that Dr. Watson referred doubtfully to Coursetia, as C. Mexicana. To give any notion of the nearly half a hundred new species is impossible in this brief review. The contribution, however, is creditable to the Division, and the chief Botanist deserves congratulation for the organization and promotion of this kind of work. There are some blemishes in matters of detail and a few marked inconsistencies between drawings and descriptions.

WATSON'S CONTRIBUTIONS.— Dr. Sereno Watson's "Contributions to American Botany, XVIII" is before us, appearing in Proceedings of American Academy, XXVI, 124–163. Part 1 contains the description of eight new species, chiefly from the United States, and a revision of the American species of Erythronium. Thirteen species of Erythronium are recognized, but one of which is new, although *E. mesochoreum* Knerr may be considered as such. Part 2 contains the descriptions of new Mexican species from the Pringle collections of 1889 and 1890. Among the 88 new species there described, two new genera appear, viz.: *Neopringlea*, to replace the preoccupied Llavea, a genus usually placed with the Celastraceæ, but whose affinities are shown to be in the Sapindaceæ; and *Oligonema* (now *Golionema*), a genus of homochromous Asteroideæ. Part 3 is concerned with a wild species of Zea from Mexico, described under the name *Z. canina*. At first thought to be the original wild state of our cultivated maize, Dr. Watson now considers it a distinct species. Part 4 contains some notes upon a collection of plants from the Island of Ascension, including three new species, a Rubus, an Asplenium, and a Nephrodium.

SUPPLEMENTING the above is Mr. B. L. Robinson's "Contribution from the Gray Herbarium," in the same volume of Proceedings of the American Academy, pp. 164–176. It contains descriptions of new plants from the Pringle collections of 1889 and 1890, twenty-six species, chiefly Gamopetalæ, being established.

PROF. F. LAMSON-SCRIBNER has just issued a paper (Proceedings of Philadelphia Academy, 1891, 292–309) treating of the Mexican grasses collected by Pringle in 1890, and also by an expedition in the same year from the Philadelphia Academy. Pringle's grasses number thirty-six species, three of which (Muhlenbergia) are new, although a good deal of synonymy is corrected. The paper contains a full page plate and two cuts in the text.

MR. THOS. MORONG has published notes on the North American Halorageæ which appear as a reprint from the *Bulletin of the Torrey Botanical Club*, 18, 229–246. Hippuris is made to contain three species.

Callitriche is credited with eleven, one of which, C. longipedunculata, is a new species from S. California. Proserpinaca includes two species; while Myriophyllum contains twelve. In the last genus M. ambiguum, var. limosum Nutt. becomes M. humile (Raf.), and M. scabratum Michx. becomes M. pinnatum (Walt.)

MR. A. P. MORGAN has issued the fourth paper in his series on North American Fungi, being a reprint from the *Journal of the Cincinnati Society of Natural History,* April, 1891. It treats of the genus Lycoperdon, which is made to contain thirty-one species, two of which are new. The paper is illustrated by two plates.

Minor Notices.

MR. J. S. CHAMBERLAIN has been making a comparative study of the styles of Compositæ. His paper containing 22 pp. and four plates, is issued as a reprint from the *Bulletin of the Torrey Botanical Club,* xviii, 175. Mr. Chamberlain concludes that while style characters are very useful in the classification of tribes, they cannot be relied upon entirely.

AN ENLARGED and greatly improved edition of Woolls' "Plants indigenous and naturalized in the neighborhood of Sydney" has just been issued. The plants are arranged according to the system of Baron F. von Mueller. The species of vascular plants number 1465, of which 175 are naturalized.

A VERY VALUABLE contribution to the literature of Geographical Botany is the paper just published by Mr. Warren Upham in *Proceedings of the Boston Society of Natural History,* 25, 140–172, entitled, "Geographic limits of species of plants in the basin of the Red River of the North." Mr. Upham's extensive investigations into the glaciology of that region, combined with his botanical training, have well fitted him to discuss the relation of plant distribution and migration to climate.

THE ANNUAL REPORT of the Geological Survey of Arkansas for 1888 has just appeared. Half of the report is devoted to a list of the plants of Arkansas, together with some general discussion of the state flora, by John C. Branner and F. V. Coville. The list does not pretend to speak of geographical distribution, but any fairly complete list of plants from Arkansas is of interest.

PROF. CONWAY MACMILLAN has distributed a reprint of his article in the *Revue général de Botanique,* on the European plants which have been introduced into the valley of Minnesota.

OPEN LETTERS.

Where is the home of Calypso?

I was much interested in Mr. Blanchard's notes on this dainty plant in the August number of this paper, for every botanist loves Calypso. If abundance of individuals is to determine the true home of the Calypso, then the Puget Sound region will easily bear the palm from northern Vermont. Fifty or one hundred specimens in half a day does not not seem at all impressive to me, for I have frequently gathered bouquets of several hundred in a few hours; and only two years ago I saw a boy selling bunches of 100 or more for ten cents, a fact which speaks more for the abundance of the plant than for proper local appreciation of its beauty. What is particularly interesting is that the habit of Calypso here seems to differ very decidedly from its habit in the east. The plant here never grows in Sphagnum bogs; indeed from my experience with it, I would nearly as soon look for it on exposed rock as in Sphagnum. I find it in rather dry and open coniferous woods, especially where the ground is covered with Hypnum Oreganum. It seems to have a decided preference for this moss and an almost equal antipathy to Hypnum splendens.

It would perhaps be better for Calypso did it grow here in Sphagnum, for its home in dry Hypnums renders it peculiarly subject to destruction by forest fires. I know of many places where a few years ago it was abundant, that will never again be brightened by its dainty slippers, all owing to fires. So I shall not be surprised if in a very few years the plant will be found more abundant in Vermont than it will be here.

I find that a large proportion of the plants here are fertile. The only insects I have seen on the flowers were ants, which were feeding on the nectar. I am inclined to believe that they are not the usual, if indeed at all, the fertilizers of Calypso.— CHAS. V. PIPER, *Seattle, Wash.*

Botanical Clubs in California.

A paragraph in the July GAZETTE mentions the organization of a botanical club in San Francisco. The beginning of this year witnessed the formation of two, one in Berkeley and one in San Francisco. The former dates from February 25, and is named the Chamisso Botanical Club, in memory of the distinguished botanist who visited the California shores in the early part of the century. It grew out of a purely spontaneous desire on the part of a number of post- and undergraduate students to engage in some work that would contribute to the knowledge of the California flora, and to this end they perfected an organization in which the professor of botany was in no way concerned and of which he was entirely ignorant until after the young society was fairly on its feet, and had mapped out for itself a special line of work. The members have been engaged in the accumulation of material for an annotated list of the plants growing within twenty miles of San Francisco, and have discovered many species new to the region and expect to "undiscover" a few that have been credited to this locality and do not grow here.

The other is the California Botanical Club, organized in San Francisco March 5, much more pretentious in point of membership, its roll bearing at last accounts one hundred and twenty-five names. On the list are the names of some well-known botanists of the Pacific Coast; but the majority are ladies who are interested in ferns and flowers. The club has a field of usefulness, in teaching and interesting in botany those who have leisure, and thus enlisting a larger number in the work of collecting and exploration — a work which is, in this state, only well begun.— WILLIS L. JEPSON, *Berkeley, Cal.*

NOTES AND NEWS.

PROFESSOR DR. GOEBEL has accepted a call to the University of Munich as Professor of Botany and Director of the Botanic Garden.

MR. ARTHUR LISTER, in *Journal of Botany* (Sept.), has published some notes on Mycetozoa, accompanied by four plates. The paper is a notice of the species not included in Dr. Cooke's "Myxomycetes of Great Britain," and contains the description of three new species.

THE HERBARIUM of the late Dr. C. C. Parry has now been arranged for sale, together with an extensive library of botanical works. A catalogue has been issued, which shows 6,780 species, represented by about 18,000 specimens. Of these 5,290 species are North American. Full information can be obtained from Mrs. E. R. Parry, Davenport, Iowa.

IN ANSWER to a request from the city council of Cleveland, Ohio, the U. S. Department of Agriculture detailed Prof. J. C. Arthur, as an agent of the Forestry Division, to examine into the causes of the injury and death of the shade trees of that city. His report ascribes the injury to the excessive quantities of coal smoke, more particularly to the noxious gases which accompany the smoke.

SPHÆROTHECA LANESTRIS Hark. has been supposed to be confined to California, and to a single host, *Quercus agrifolia*, but both the conidial and the mature forms have been found this season in Mississippi, by S. M. Tracy. It occurs on *Quercus prinus, alba, macrocarpa* and *falcata*, and is rather abundant. The conidial form has also been found in Alabama on Q. alba, by Mr. Geo. E. Atkinson.

FR. JOHOW, who has given much attention to phanerogamous parasites, proposes the following grouping for them, based upon habit: 1. euphytoid parasites, erect land plants, including five families with 35 genera and 400 species; 2. lianoid parasites, including the genus Cuscuta with 77 species and Cassytha with about 20; 3. epiphytoid parasites, tree-dwellers, including 500 Loranthaceæ and 15–18 antarctic Santalaceæ; 4. fungoid parasites, including about 60 species of the two families Balanophoreæ and Cytinaceæ.

AT A MEETING of the Royal Society of Canada, held May 29th last, a club was formed by the botanists present, to be known as the Botanical Club of Canada. It has no connection with the Royal Society other than that which all scientific and literary societies enjoy.

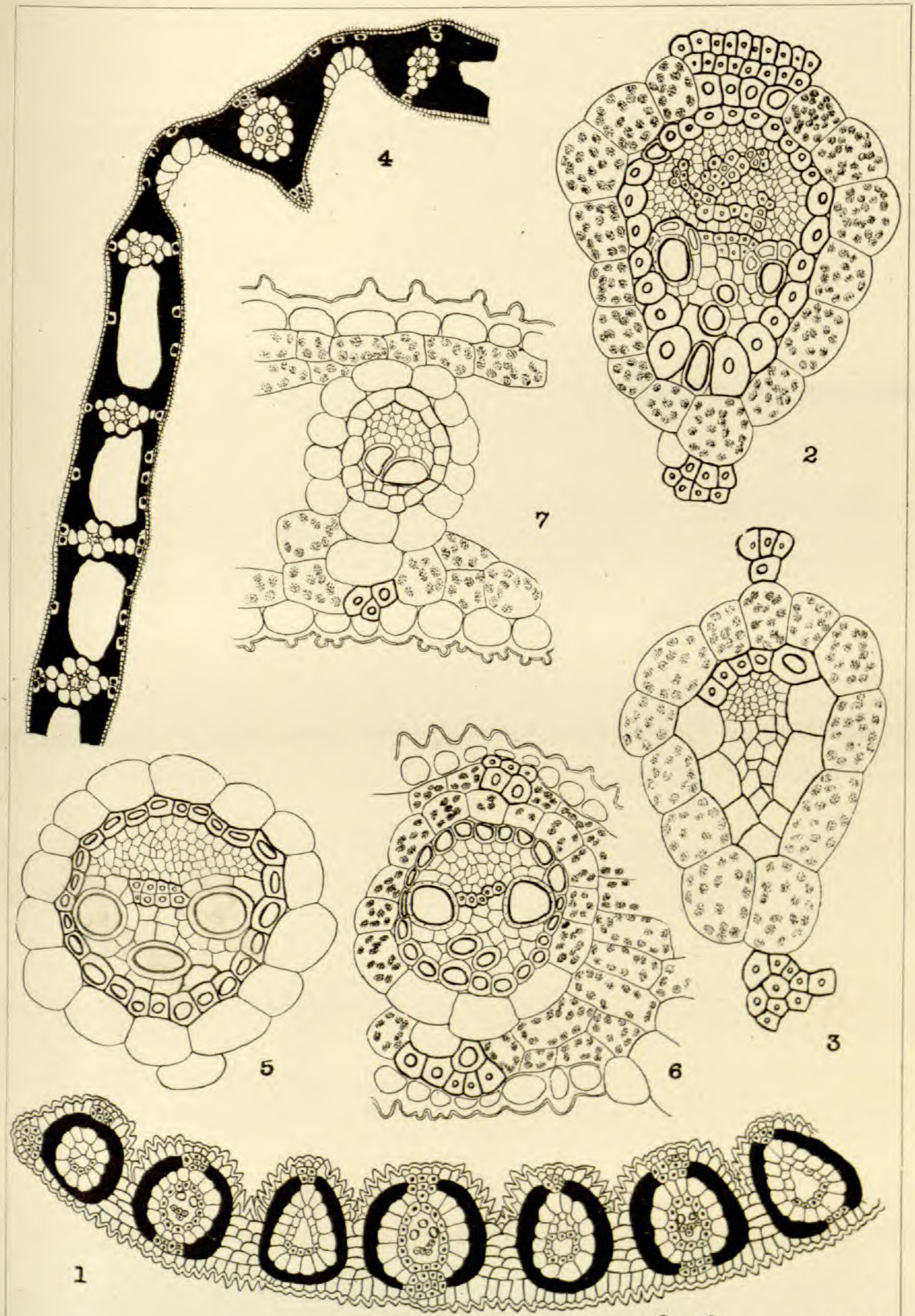
The object is to adopt means, by concerted local efforts and otherwise, to promote the exploration of the flora of every portion of British America, to publish complete lists of the same in local papers as the work goes on, and to have these lists collected and carefully examined in order to arrive at the correct knowledge of the precise character of the flora and its geographical distribution.

The method is to stimulate, with the least possible paraphernalia of constitution or rules, increased activity in the botanists in each locality, to create a corps of collecting botanists wherever there may be few or none at present, to encourage the formation of field clubs, to publish lists of local floras in the local press, etc., etc. Any person interested in the study of botany is eligible.

The general officers for the year are: Dr. George Lawson, of Halifax, president; A. H. MacKay, of Halifax, secretary and treasurer. There is also a secretary for each province, who will, in turn, appoint local secretaries in such localities as he may deem expedient. It is the duty of the local secretaries to stimulate botanical research in their districts, and to endeavor to secure such notes on occurrence and situation of specimens, as may eventually enable the club to publish a special catalogue of the flora of the region. We wish the new club success.

M. GUSTAVE CHAUVEAUD has investigated in great detail the non-articulated laticiferous tissue and the account of his study forms parts 1 and 2 of the *Annales des Sciences Naturelles*, Botanique, 7, xiv, pp. 160, 8 plates. The subject has long needed investigation. We translate his conclusions:

The continuous primitive laticiferous apparatus is formed by special initial cells which are the first elements of the embryo differentiated. These initial cells, rarely four, sometimes eight, frequently more numerous, are of constant number in each species. They appear always in the same transverse plane (the nodal plane), and are formed in most cases at the expense of the pericycle. They elongate into tubes and become much branched, constituting in the embryo a complex system often of great regularity. Later this system increases and furnishes the laticiferous system of the seedling and the adult plant. In case the plant acquires secondary formations, these formations are traversed by laticiferous tubes springing from the branches of the primitive laticiferous system near the generating layers. The appearance of new initial cells has not been observed after the first stages of embryonic development. The tubes do not show anastomoses nor transverse partitions. The branches in certain species are distributed through the pith as well as through the bark. Their terminations are not localized in a special tissue; they are found in the leaves and cotyledons either in the midst of the parenchyma or underneath the palisade cells or even more frequently in contact with the epidermis. In certain plants the continuous tubes seem to precede the appearance of the articulated tubes. Finally, they are not met with except in the Euphorbiaceæ, Urticaceæ, Apocynaceæ and Asclepiadaceæ, where they serve to characterize certain tribes.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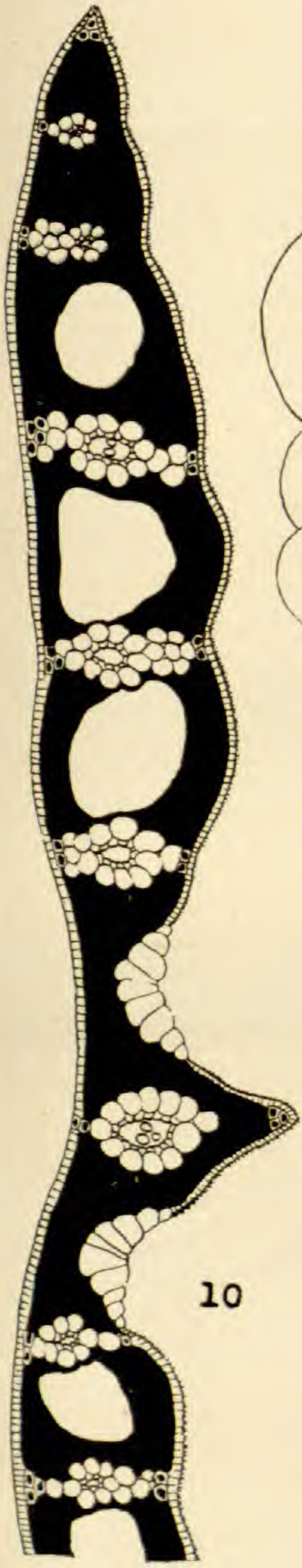

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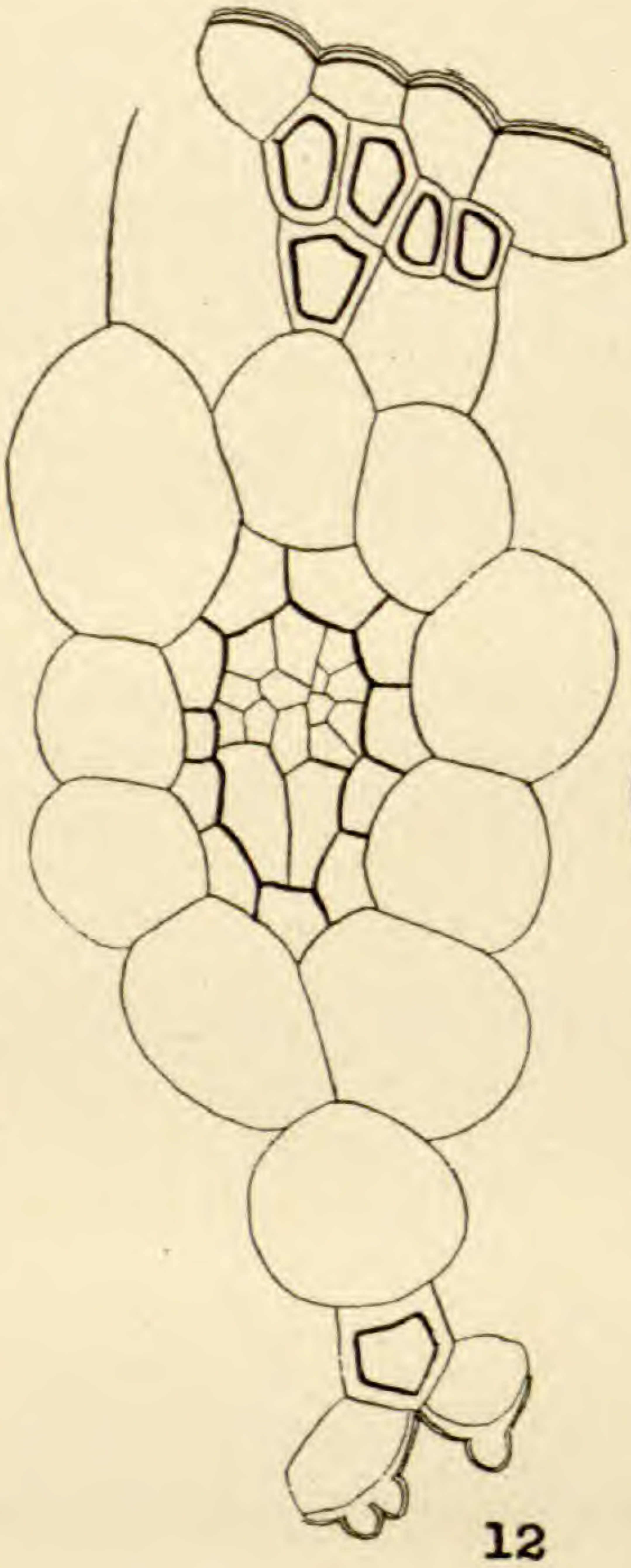

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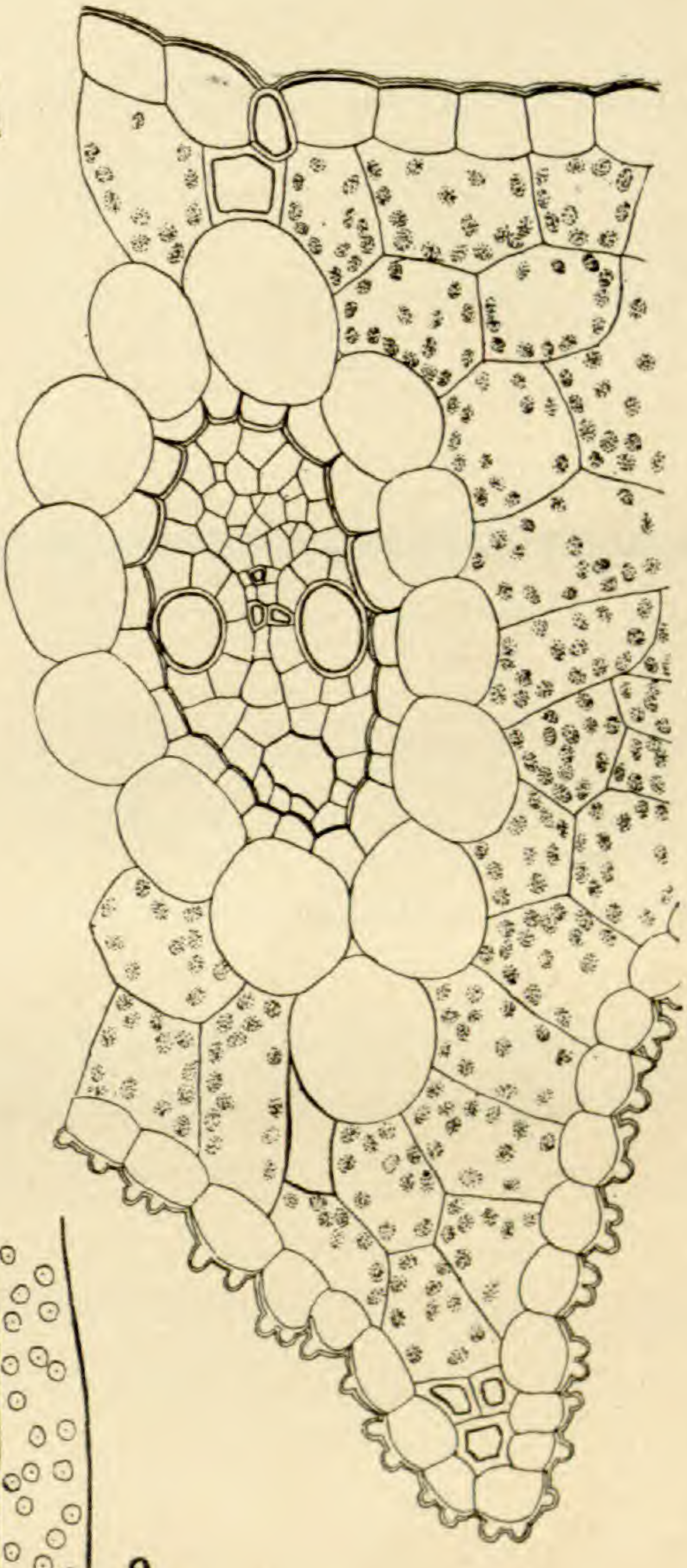

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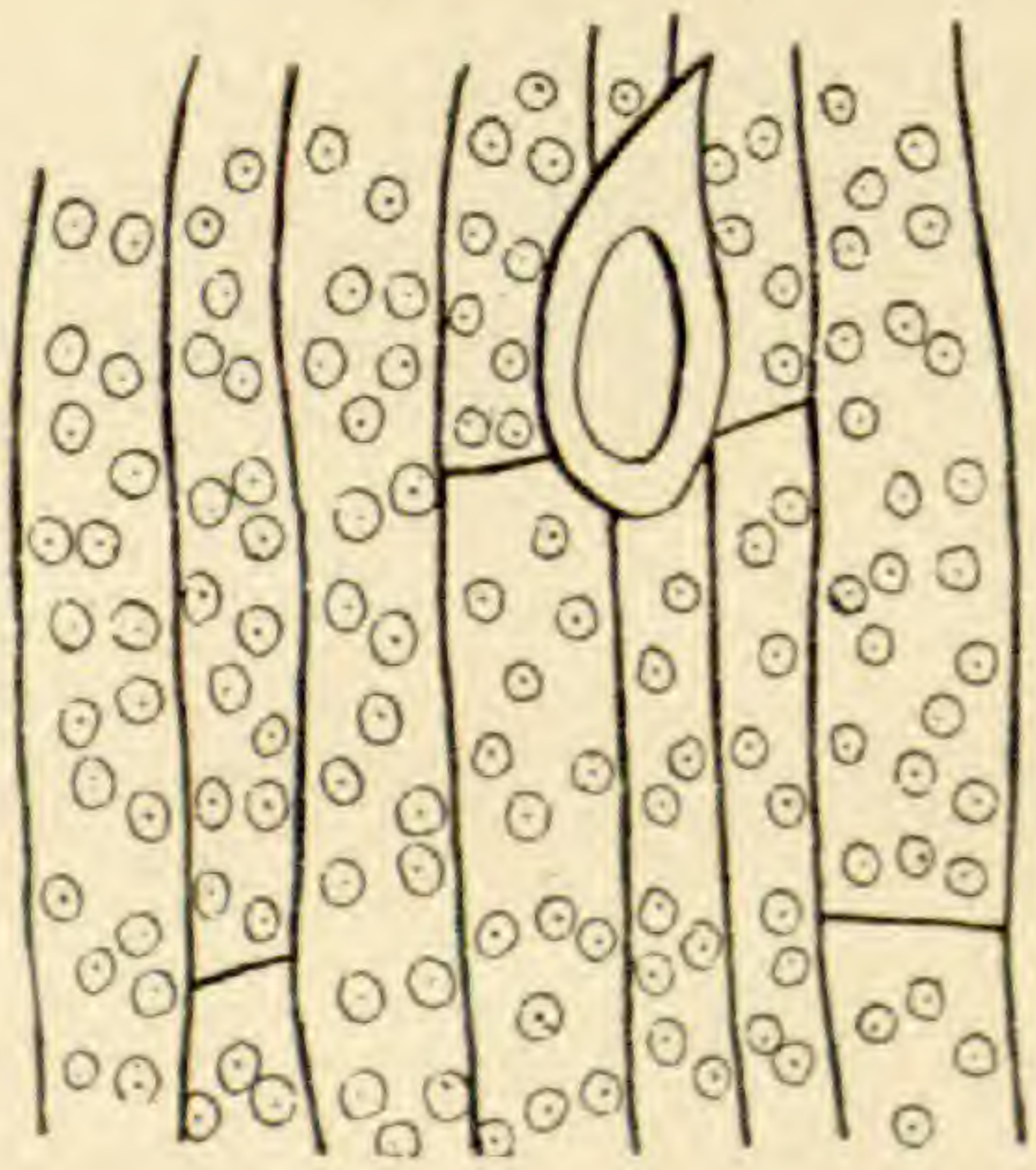

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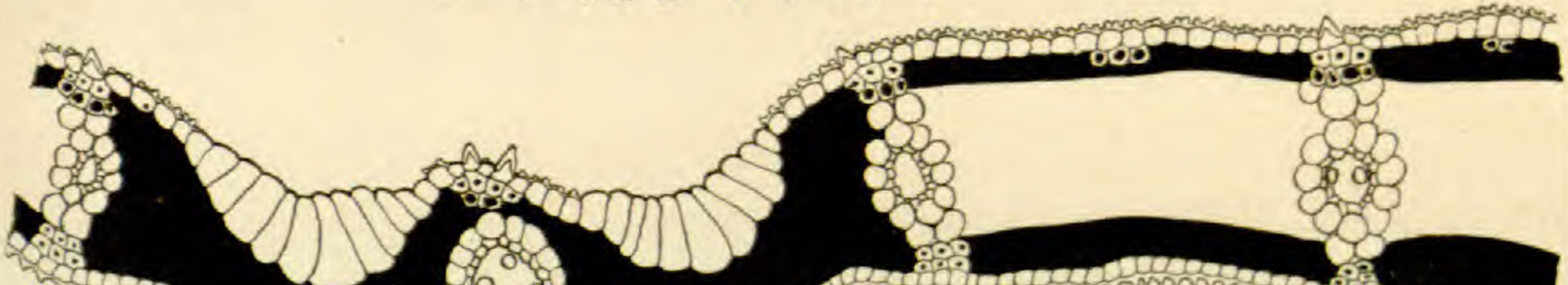

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VOL. XVI. NO. 11.—BOTANICAL GAZETTE.—NOV., 1891.

The sling-fruit of Cryptotænia Canadensis.

E. J. HILL.

While passing through the woods in the autumn of 1890 my attention was called to the rattling of seeds falling on the dry leaves which thickly covered the ground. Stopping to see from what plant they came it was found to be Cryptotænia Canadensis. Not knowing that there was anything peculiar in its structure, trials were made of several plants to learn by what contrivance a single one could throw its fruit all around it under the influence of a blow. By striking the stems near the base the fruit was scattered in all directions, some being thrown to a distance of five or six feet. The space on which it fell was somewhat elliptical in shape, the longer diameter being in the line of direction of the blow. It seemed a little paradoxical that a body, unless rebounding from a surface against which it had been thrown, should traverse the path over which the impulse came, but the fact that it did was not to be denied after repeated trials had shown it. Here was a phenomenon to be studied and an explanation found. It was evident that the behavior of the fruit was in some way connected with the elasticity of the stem and branches and its mode of attachment to them. This was about all that was determined on the spot, for the fruit broke away from its support so suddenly that the eye could not readily follow the motion. Almost simultaneous with the blow the sound of impact on the dry leaves was heard. Some plants were carefully gathered and placed in a vasculum to be taken home for study. The experiments then tried have been repeated the present season, and the conclusions reached at the time confirmed by numerous trials. The mechanism and operations by which the fruit is scattered are about as follows.

The mericarps of Cryptotænia when fully ripe split away from each other and hang from the two parts of the carpophore, which are separated above, like a versatile anther on its filament. The branches of the carpophore are flat and very slender. They curve over and are often bent a little downward at the end by the weight of the carpels, which hang opposite to each other when in their normal position. At this stage in the process of ripening, the carpels have been detached from the carpophore for the greater part of their length, only a small part of it adhering at the extremity. To be completely detached it needs to be stripped up, for the loosening of the carpel takes place from below upward. But the adhesion at the top may be strong enough to turn the fruit over while released under the force of a sudden blow. So it will be slung from its support and propelled the lower end foremost. This end, being less tapering and rather heavier, will facilitate the process.

To illustrate my meaning by a pair of carpels, we will consider the blows as coming from the right hand. By the displacement of the stem to the left under this impulse, and its sudden stoppage when the limit of motion is reached, the energy imparted to the right hand carpel will cause it to turn over in order more easily to tear itself away and it will be thrown to the left of the plant. In some cases it may be jerked from its support and thrown somewhat to one side, being diverted from the line of direction of the blow by stronger adhesion to the carpophore and propelled with a diminished intensity. The left hand carpel may also be detached, particularly if the blow be violent, and thrown forward with the right, since more fruit is sent towards the point to which a blow tends than in the opposite direction. But it often remains attached, the arched and slender carpophore seeming to act like a spring to weaken the shock it would have received, and the carpel is carried forward with the stem on which it is supported, to return with it to the position of rest, or beyond, should the reaction be sufficient. The sudden stopping of the stem when the limit of motion is reached on the return will have an effect on the carpel like that in the former case, but in the opposite way, sending it to the right, or towards the point from which the blow tends.

The clue to this explanation was obtained by experimenting with plants held in one hand and snapping the branches bearing the umbels with the fingers of the other. While working in this way, one of the carpels flew from the stem held in front and a little to one side, and shooting by fell on a table back of my chair. It was heard to fall on some paper lying on the table, and was readily found. The distance from where it was held to where it lay was nearly five feet, and, being quite close to the nearer edge of the table, it must have remained about where it dropped. The line of direction taken varied but slightly from that along which the blow was delivered. By spreading papers on the floor and experimenting when standing I have found the carpels lying eight feet back of the vertical in which the stem was held. This is a longer distance than would ordinarily be reached by fruit thrown from a plant at its common height.

The scattering of the fruit along the shorter radii of the elliptical area may be explained by the form of branching and inflorescence of the plant. There are several branches terminating in compound umbels, and the ultimate divisions of the stem in the rays of the umbellets are sufficiently numerous to point in all directions. By the principle of physics known as the composition and resolution of forces, resultants will be obtained from the application of a single force and the position of the carpels and their adhesion to the carpophore to coincide with numerous radii. But the distance to which a carpel may be thrown along these lines will necessarily be less than that coinciding with the longer diameter, for the length of a resultant is less than the sum of its components when forces act at an angle with each other, and their intensity is diminished. This, in connection with features previously announced, accounts for the shape of the area covered by the fruit.

Longitudinal sections of the branches of Cryptotænia show that it is well supplied with dotted and spiral ducts, the spiral being abundant. They are very long and numerous near the pith, and will contribute to the elasticity of the stem.

The only other way of accounting for the behavior of this plant in scattering its fruit appears to be that it acts like a bat and ball, the rays of the umbellets striking the carpels and knocking them off, either by their forward movement or on their return. But they seem too slender to have this effect on the relatively heavy fruit, the missile being considerably larger than the body striking it, and suspended in such a way as to receive the blow at the lower end alone. Still this may enter into the process and help in some cases. The mechanism of a missile attached to the end of a spring, or even rigid body, in such a manner as to be easily thrown off by its motion explains the action much more effectually. Here the individual parts may be slender though the projectile is heavy, since the strain exerted by the force is distributed through a greater length, and is not so violent at a particular point. But the strain is very great when a ball is struck by the end of a bat, as would be the case with the rays of the umbellets, for the center of percussion, where a blow is most effective and where the strain is least, is considerably below the end of a body of nearly uniform thickness. But observation shows that the ends of the rays are not broken in the disengagement of the fruit.

Whether this mode of disseminating fruit is common among the Umbelliferæ is doubtful, because, if frequent, it probably would have been observed in other cases. However, more extensive observations on this point are needed before expressing a decided opinion. But as yet I have seen none that acts in the same manner. But the way in which the carpels split off from the carpophore and are suspended from it must in general facilitate the dispersion of the fruit of Umbelliferæ by shocks received from passing animals, and doubtless from gusts of wind, though not acting like a sling as in Cryptotænia. In an article by Hildebrand on this subject, mention is made of a single genus of Umbelliferæ, *Scandix*, in which the fruit is thrown from its support. But this is due to the tension to which the dry fruit is subjected when adhering to the carpophore, which causes it to be thrown to the right and left through its elasticity when released from stress, and is compared to that which occurs in *Erodium*.[1] This is the only case among the Umbelliferæ of fruits flying off by means of their elasticity cited in his more general treatise, "Die Verbreitungsmittel der Pflanzen," though several other modes of dispersion, with examples in illustration, are given for this family.[2]

Englewood, Chicago.

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[1] Die Schleuderfrüchte und ihr im anatomischen Bau begründeter Mechanismus. (Jahrb. für wiss. Botanik, IX. 270.)

[2] l. c. p. 140.

Bacteria of the Melons.[1]

BYRON D. HALSTED.

Early in July there were many complaints throughout the country that the melon, squash and cucumber vines were either not doing well or dying from some unknown cause. The first specimens to arrive were from Bangor, Me., followed by others from the central part of New Jersey, a locality famous for its production of cucurbitaceous fruits.

The attacked vines vary somewhat in their appearance, but generally there is a decay of the stem in proximity to the root, and then the whole plant wilts and fails to grow. Sometimes one or more leaves will fall to the ground and rot away before the balance of the plant is seemingly affected. This is particularly true of the cantaloups, while in the case of cucumbers the fruit may be the first to show the trouble. Here the half grown cucumbers exhibit from one to a dozen or more specks looking like "water cores," which increase in size, until the whole of the fruit becomes a rotten mass, the firm skin still holding the watery interior in shape.

A microscopic examination of the decaying stems, leaves and fruit showed that the decomposing tissues were teeming with bacteria. This was to be expected, but it remained to prove that these germs could be the primary agent in the decay. Inoculations of healthy fruits were made in the usual way by means of sterilized platinum wire. taking the germs from the centre of freshly decaying cucumbers. It was found that with no other fungus present these germs were abundantly able to introduce a rapid decay into cucumbers, melons and squashes. Cucumbers seem to be the favorite, and in them the decay is the most rapid. It will run from one end to the other through the succulent centre of a four inch fruit in a single day. From the placentae the rot spreads towards the surface until all is a noisome pulp inclosed by the skin which may remain unbroken if the inoculation has been made at the stem end.

The next step in the study was the application of these germs to healthy plants in the field. This was done by means of a flamed glass tube one end of which had been drawn out into a long point. By means of this, the germs in liquid, after being drawn into the tube, could be introduced into any part of the plant, even into the woody base of squash vines. When the inoculation was made near the end of a vine, the latter rotted away in from three to four days, and when nearer the base a longer time was required, but in all cases an ulcer was formed which spread more or less rapidly depending upon the tissue infected. In old stems the decay was almost entirely internal, and did not show much until the disease had spread through the pith to some distant soft parts. A medicine dropper was employed to place a charge in the middle of several petioles of large squash leaves. Upon the next visit, twenty-four hours after, all such leaves had fallen to the ground, and the portion of the petioles below the point of inoculation, six or more inches in some cases, were thoroughly decayed. In short, the bacterial disease first found in the cucumber and afterwards propagated from fruit to fruit in the laboratory, as also upon cut stems and petioles, is readily transmitted to vigorous living vines of the cucumber and squash in the field.

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[1] Read before Section F, A. A. A. S., Washington meeting, August, 1891.

Sixteen seeds of summer crooked squash were divided into two equal lots, and each set of eight planted in a flower pot under a bell jar and in every way treated alike, except that the soil of one pot was watered at the beginning of the experiment with the juice of a cucumber which had decayed with bacteria. The eight seeds not receiving the bacterial liquid germinated quickly producing large, deep green plants, while in the other pot only two plants appeared above ground, and they were of a dwarfed, sickly, yellow color, and did not continue to grow. These two plants were quite close to the side of the pot and did not receive a full wetting by the bacterial water. The remaining six seeds when removed from the soil were decayed and noisome.

Eight seeds were next placed upon blotting paper, moistened with distilled water, and kept covered in a small artist's saucer, while a duplicate set were similarly placed, but wet with a solution containing bacteria from a decaying cucumber. Here again the untreated seeds all grew with usual vigor, while those in contact with the bacterial germs failed to germinate and soon decayed.

The pure virus was next introduced into the growing stems and green fruits of the tomato, and in both cases quickly produced a decay that caused the stems to fall and the fruit to become a watery mass inclosed by the skin, similar to the cucumber from which the bacteria were taken for inoculation. At the time of the experiments some boxes of young tomato plants were close at hand, and into the centre of one of these a decaying cucumber was placed. In six hours some of the stems of the tomato plants six inches in height had rotted off close to the ground, where the liquid from the decaying fruit had come in contact with the young plants. In ten hours all the plants in the vicinity of the decaying cucumber were destroyed. Drops of the virus placed in the leaf axil of other plants quickly induced decay and death of the parts.

The virus from a cucumber was also used upon potato vines in the same manner as upon the squashes, but both the extreme age of the plants and the dry weather may have been unfavorable, as the decay was slow and comparatively harmless. Healthy tubers, however, when inoculated with the cucumber bacteria rotted with that rapidity characteristic of the bacterial decay of the potato. In all cases the tuber became of a pasty softness, and gave off a most unpleasant odor. This decaying substance when taken back to fresh fruit of the cucumbers continued to produce rapid decay.

Rutgers College, New Brunswick, N. J.

Interesting anatomical and physiological researches.

The leaves of aquatic monocotyledons.

M. Camille Sauvageau has just brought to a conclusion his noteworthy memoir[1] on the leaves of some aquatic monocotyledons. To the physiologist this contribution to a little known department of botanical science is no less interesting than to the morphologist. The studies of the author have been principally upon the *Potamogetonaceæ* (see Ascherson's monograph in Engler and Prantl: *Die natürlichen Pflanzenfamilien)*, and for the forty-eight species examined he announces that the histological characters of the leaf alone will be sufficient for identification. He finds, moreover, in *Zoste-*

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[1] Ann. Sci. Nat., Botanique, 7. 13, pp. 102–296; *Sur les feuilles de quelques monocotyledones aquatiques.*

ra, *Phyllospadix*, *Halodula* and *Potamogeton* that there is a remarkable water-pore at the apex of the leaf, formed by the disintegration of certain epidermal cells. This pore is in communication with the vascular system of the leaf and together with the ordinary stomata on the under surface facilitates the passage of a current of water through the whole organ. By means of immersing cut-off shoots of *Potamogeton*, etc., imbedded in the ends of bent thistle-tubes containing water and attached to a mercury pressure-guage, in jars of water, Sauvageau demonstrates experimentally the absorption of water by the leaves. He concludes that there are currents of water, comparable to the water-current of transpiration in land-plants, in the leaves of the *Potamogetonaceæ*, and that, when deprived of their roots, these plants may continue to live and prosper by absorbing water and salt-solutions through their leaves. Plasmolytic phenomena noted indicate that in these plants the absorption of water may take place over the whole surface of the leaf.

In general it may be said that these extremely able and careful investigations of Sauvageau go far to show that absorption of water is, in some cases, an "important normal function" of leaves. This has not yet been entirely clear, notwithstanding the well-known experiments of Mayer and Boussingault. —CONWAY MACMILLAN.

Structure of living protoplasm.

Probably the recent article by M. Fayod[1] upon this subject is as startling and difficult to reconcile with preconceived and accepted notions, as any physiological memoir that has appeared since the early days of karyokinesis literature. M. Fayod announces that protoplasm is not an emulsion, as it has lately been characterized by Bütschli and Quinke, nor is it a zoögloea-like by-product enclosing bacterioid *zell-granula*, as the Hartigs have indicated, nor a "complicated mixture" as Berthold somewhat indefinitely calls it. It is, on the contrary, a highly intricate network of spirally twisted, corkscrew-like, hollow fibrillæ, each possessing a hyaline wall negative to all staining reagents and capable of great dilation by the liquids or emulsions within. The nucleus is a peculiar knot of *spirofibrillæ*. The cell-wall possesses exactly the same organization as the protoplasm. It is protoplasmic fibrillæ impregnated with cellulose. Certain obscure physiological problems are luminously explained under this view, viz., cell-growth, geotropism, ascension of sap, irritability in general, heliotropism, budding, and movements, such as those of amœbæ, plasmodia, bacteria and the diatoms. The method of M. Fayod—leaving aside the detail—is to inject bits of tissue with indigo, very finely powdered and in suspension. The preparation is dehydrated with alcohol after the usual method, and is examined in clove-oil. In this way it is possible to inject the spirally-twisted protoplasmic fibrillæ and thus expose them for examination and study. In seed-coat cells of *Cuphea* for example, the spirofibrillæ are found to have exactly the structure of a capillitium-fiber from certain *Trichias*—a genus of *Mycetozoa.*

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[1] Rev. générale de Botan., May, 1891; *Structure du protoplasma vivant.*

This distinctly original view of protoplasmic constitution will, of course, need verification. It seems certain that peculiar spirally-twisted elements may be demonstrated in protoplasm by any one who follows Fayod's method, which is not a tedious one. The writer obtained results with epidermal cells from young *Pelargonium* leaves.

With the space at command, it is not possible to discuss fully the ingenious explanations which, under his conception of protoplasm, M. Fayod offers for the various physiological phenomena which present themselves to his notice. To most readers of his paper, however, it is certain that no page will be more interesting than the one on geotropism. Very simple, physical and mechanical laws suffice for the explanation of this *crux* of plant-physiologists. By the weight of liquids in the spirofibrillæ, under the action of gravity, longitudinal tension, in the cell-lining, is decreased and cell-formation takes place more readily along the line perpendicular to the surface of the earth. And the more gross materials will collect in the lower portions of fibrillæ and in the lower fibrillæ, leaving the finer, ethereal, easily dialysable substances uppermost, thus tending to inflate upper parts of fibrillæ and upper fibrillæ. Under such conditions of the mechanism, together with the variation of environment, nutritive rhythm, and changes periodic and constant in metabolic processes and products, Fayod finds little difficulty in explaining very clearly both geotropism and negative geotropism (*zenotropism,* turning toward the zenith). He quotes effectively the experiments in aggregation of Drosera-protoplasm which have become classic, and notes the more recent results of Elfving and Wortmann who find that the protoplasmic layer is thicker on the *under* side of cells in a negatively geotropic (zenotropic) organ.

It is impossible to dismiss so carefully prepared and important a paper as this of Fayod with a shrug of the shoulders, as has been done, the author observes, with his earlier notes on the matter. Especially in view of the recent advances in karyokinesis study, as indicated in the researches of Watase, Guignard, Carnoy, Zacharias, Pfitzer, Strasburger and others, it is evident the older emulsion-theory of protoplasm is beset with grave difficulties. It is probable that even so admirable a work as Berthold's *Studien über Protoplasmamechanik* does not say the last word upon its subject-matter. Fayod's paper is an original and valuable contribution to the most fundamental question of both plant and animal physiology.—CONWAY MACMILLAN.

The relations of the phloem.

Within a few years our knowledge of the phloem region of the fibro-vascular bundles has been greatly extended. Not to go so far back as 1885, in which year appeared Hérail's Étude de la tige des Dicotylédons[1] in which the phloem received extensive consideration, we have last year Lamounette's extensive researches into the origin of the internal liber of the so-called "bicollateral" bundles.[2] Lamounette rejects the term "bicollateral" as did Herail, who considered it applicable only to the Cucurbitaceæ. In this terminology the internal phloem was looked upon as coordinate with the external phloem; whereas according to Lamounette (whose researches agree generally with those of Hérail where they touch common ground) the internal phloem is not developed from the procambium which produces the bundle, but arises from the pith parenchyma. It is not always easy to distinguish these two tissues, though in most cases this is easy because the internal phloem arises later than the xylem, so that the first formed spiral and annular vessels come to indicate the internal limits of the procambium before the internal phloem begins to develop. In the Cucurbitaceæ, however, the differentiation takes place at the same time, but even in this case Lamounette will not allow the applicability of the term "bicollateral." Every gradation in time of appearance is found between the Cucurbitaceæ and the Basellaceæ in which the appearance of the internal phloem is very late.

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[1] Annales d. Sci. Nat. Bot. VII. ii. 267.

[2] Annales d. Sci. Nat. Bot. VII. xi. p. 193–278.

Lamounette investigated the hypocotyl, stem and cotyledons of a large number of plants by the aid of serial sections cut by the collodion method.

At the beginning of this year Leonhard published his researches into the anatomy of the Apocynaceæ[1] which show that the internal phloem occurs throughout this order, with possibly one exception.

In the August number of the Annals of Botany Scott and Brebner have an extended account of their studies as to the relation between the stem and root-structure in plants with bicollateral bundles and the special modifications of the stem-structure in plants which belong to this category. They adhere to the term bicollateral as a matter of convenience without expressing any opinion as to the order of development, and cite the term "vascular bundle," as a convenient expression not now generally representing a well-defined unit, but applied to vascular tissues even when the limits of the individual bundles cannot be traced. "So long as an internal phloem strand has the same longitudinal course as the neighboring bundles of the leaf-trace there is no serious objection to regarding them as parts of the same formation."

"Bicollaterality is a character widely prevalent among the most highly organized dicotyledonous families [18 are known] and of great systematic value. It may fairly be maintained that these orders represent in certain directions the most advanced types of dicotyledonous structure.

"The physiological importance of bicollaterality cannot be fully estimated until the general question of the functions of the phloem has been finally determined, but it is undoubtedly great. The sheltering of a portion, often the larger portion, of the delicate phloem within the woody cylinder is an obvious advantage, as is also the fuller utilization of the pith-area and the consequent concentration of the tissues generally. It is probable also that the pith-cells themselves may be able to discharge both storing and conducting functions more efficiently when brought into direct relation with the phloem and its proteid contents.

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[1] Botanisches Centralblatt, xlv. p. 1.

"In concluding we wish to point out the bearing of our subject on a theory which has recently been put forward as to the function of the phloem in general. In opposition to the prevailing view that the phloem is primarily a conducting tissue for the nitrogenous and especially for the proteid food-substances of the plant, Prof. Frank and Dr. Blass maintain that the phloem is essentially a store tissue for the benefit of the wood. (See this journal xv. 346.)

"We purposely avoid criticising Dr. Blass' arguments. . . . We willingly admit that in all plants with cambial growth, the supply of food materials for such growth must be an important function of the phloem. . . . But we wish to point out that the anatomical relations of the phloem are often quite inconsistent with the supposition that its principal or exclusive function is connected with the formation of wood.

"In all the numerous plants which have bicollateral bundles or an analogous arrangement of tissues, a great part of the phloem, often the greater part, and sometimes nearly the whole, is placed in that region of the stem where no formation of wood is going on, in a position as remote as possible from the wood-producing cambium, for the rare exceptions in which internal wood is formed may here be left out of consideration. Yet this internal phloem is absolutely typical in structure and contents. . . .

"So too with the phloem islands. In plants like Strychnos, these are no sooner formed than they become imbedded in dense wood, and are cut off from all direct communication with the cambium. It would be easy to cite other examples, as the stems of the Chenopodiaceæ and many other allied orders, in which almost all of the phloem is deeply imbedded in the fully-formed wood, or the monocotyledons generally, where the closed bundles retain a typical and active phloem for months and years after all formation of wood has been completed.

"In the light of facts such as these, we cannot but think that the view of Prof. Frank and Dr. Blass depends on too one-sided a consideration of typical dicotyledonous anatomy. . . . Our results as to the continuity of the various phloem-systems in root and stem tend to give further anatomical support to the theory of the conducting functions of this tissue, a theory which, we need hardly point out, is fully consistent with the view of Prof. Sachs, that the phloem may also be the seat of proteid-formation."—R.

BRIEFER ARTICLES.

Pentstemon Haydeni, n. sp.—Of the *Genuini* group: a foot or two high, glabrous, the stems decumbent, simple or branching, very leafy: cauline leaves, linear-lanceolate to linear, entire, 3 to 5 inches long by 1 to 3 lines broad, sessile and clasping: inflorescence a compactly crowded thyrse, the floral bracts from ovate-lanceolate and long-acuminate to ovate and acute, nearly equaling or the lower much exceeding the flowers; peduncles none or short: calyx-lobes acuminate, 3 to 5 lines long: corolla an inch long or more, the throat broadly dilated and the limb nearly equally lobed: sterile filament, bearded near the summit: capsule equaling the calyx.

This plant was first collected by Dr. F. V. Hayden, in the Laramie mountains of Wyoming, during some one of his early surveys, without flowers or fruit, and was referred by Dr. Gray to *P. acuminatus* as a form with linear cauline leaves. It was rediscovered during the past season, in flower and fruit, by Mr. H. L. Webber, of the Shaw School of Botany, on the Dismal River in Thomas county, Nebraska, about a hundred miles west of the 100th meridian. It has nearly the habit of the more conspicuously cordate-bracted forms of *P. acuminatus,* but with an extreme of discrepancy between the cauline leaves and floral bracts. The flowers are much larger and the throat of the corolla more dilated.—SERENO WATSON, *Cambridge, Mass.*

A remarkable orange tree.—There is in the herbarium of Brown University a specimen which is something of a curiosity. It was sent us last spring by Mr. Rowland Hazard, one of our trustees, from Santa Barbara, Cal. I quote from his letter of transmission.

"It is an orange tree which for years has lived and borne fruit without bark for a space of over seven inches entirely round the tree. I first saw this tree in February, 1885. It had been injured by a fire about three years before. When I saw it first it had a number of ripe oranges on it and in March it bloomed and bore fruit in the fall. The trunk was in substantially the same condition as you now see it. There was a space just above the ground where there was no bark and the sap-wood had rotted away, leaving only the heart-wood as the connection with the root. I bought the place on which the tree was, in 1885. The tree has borne and ripened oranges every year till 1890. In 1889 a sprout came up from the root. This proved to be a Chinese lemon on which the orange had been grafted. I was not here in 1889. When I arrived in the fall of 1890 I saw that shoots from the orange had been sent out the preceding spring but they had withered and died. The Chinese lemon was very thrifty and full of fruit. It evidently had taken the sap. The struggle was over and the orange was dead. I send you the whole of it with a part of the Chinese lemon shoot. I think it should be preserved, as it is proof positive of the circulation of sap through the heart-wood. It lived, blossomed and bore fruit every year for at least seven years, when there was no connection between the tree and the root, except the heart-wood."—W. WHITMAN BAILEY, *Brown University.*

Helianthus mollis.—Plants which I collected near Odin, Illinois, years ago, and plants from Tennesseee, sent by my friend, Dr. Gattinger, were blooming in my garden the past year. The Tennessee plants flower two weeks before the others, have involucral bracts double the length, and the leaves one-fourth broader, though no longer. The leaves of the Illinois plants are so thick that the nerves can scarcely be seen; the nerves of the other are strongly visible, and there are some other differences.

In these days variations of this character are scarcely worth special note. We find similar variations with any plant in areas of but a few acres in extent if carefully looked for.

In the Illinois plants I have noted that all the first flowers faced the southeast, the first day of opening. This season they all faced the northwest. I might settle the whole story by merely saying, "something in the environment must have influenced all these variations;" but to my mind the term "environment," so frequently used in connection with similar phenomena, is utterly meaningless. It is, however, clear that there are often separate lines of variation in widely separated localities. Sometimes I think we might solve the problem sooner if we were not so easily satisfied with the word "environment." THOMAS MEEHAN, *Germantown, Philadelphia.*

Further notes on the mutilation of flowers by insects.— In the GAZETTE for 1888, p. 39, I state that *Bombus pennsylvanicus* slits the corolla tube to obtain the nectar from *Physostegia Virginiana* and *Mertensia Virginica.* There was a mistake made in copying the name of the insect from the original notes; it should read *Xylocopa virginica*, the Virginia carpenter bee. Since the above mentioned note was published I have repeatedly seen this bee visit these two species of plants, and in addition, the following: *Pentstemon pubescens*, *P. lævigatus*, *Pontederia cordata*, *Astragalus Canadensis*, and *Trifolium pratense*. It invariably, so far as my observation goes, slits the lower end of the corolla tube in order to reach the nectary. It is said to be the largest and most bulky of all known bees, the mouth parts being very highly organized. It appears to disdain to take its food in the usual slow fashion of other insects, but goes directly through the tissues to the nectary.

I have repeatedly observed the honey bee (*Apis mellifica* L.) visit all these plants, and it apparently prefers to take the nectar through the slits that have been made by the carpenter bee; but when it does not find a slit already made, it then goes to the mouth of the tube and visits the flower in the usual way, by entering at the mouth of the tube.

The common humble-bees are frequent visitors to all these, and many other flowers, but I have never seen them take the nectar in any other way than by the mouth of the corolla. *Bombus pennsylvanicus*, *B. americanorum* and *Apathus elatus* (the latter now thought to be the male of *B. americanorum*) are the only species which I have taken from flowers, and that have been certainly determined ; but it is reasonable to conclude, from the strncture of their mouth-parts, that all the members of this genus take nectar in the same way.—JACOB SCHNECK, *Mt. Carmel, Ill.*

A new Ravenelia from Alabama.—In September, 1890, and during the autumn of 1891, the writer has collected at Auburn what proved to be an undescribed species of Ravenelia on *Cassia nictitans*. The species is remarkable for its great abundance on the stems and for the very long, fulvous pedicels of the teleutospores. It is characterized as follows :

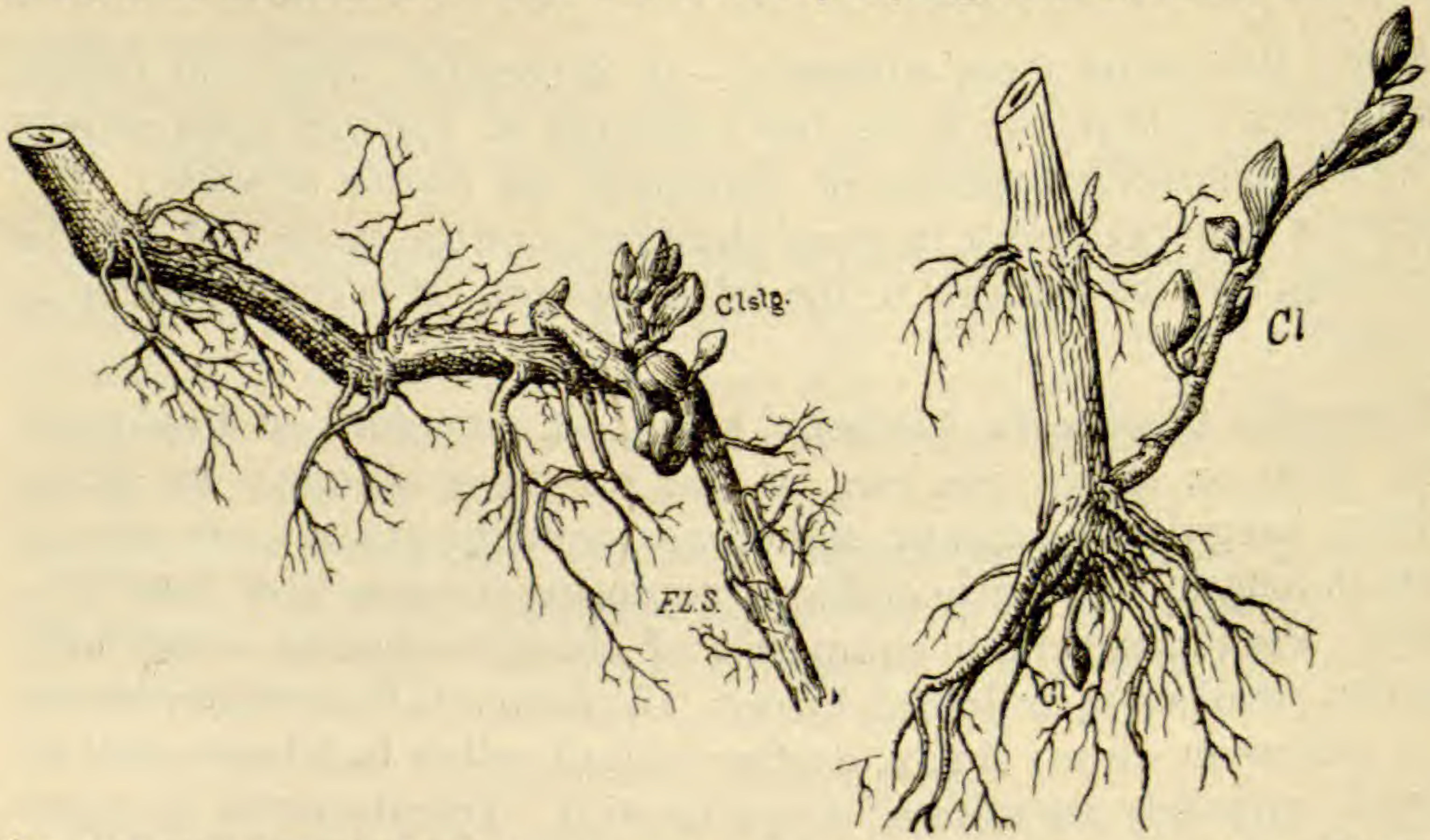
Ravenelia Cassiæcola Atkinson, n. sp.— Caulicolous or hypophyllous. Sori on leaves one mm. or less, rotund or oblong ; on stems oblong, irregular, confluent, sometimes covering space 1—10 cm. or more in length, frequently ambient, rupturing irregularly or longitudinally. Pseudo-peridium composed of closely cohering, irregu'arly angular, small cells, yellowish brown. Uredospores in mass appearing dirty yellowish white; singly, hyaline or dull yellow to fulvous, oval or rotund, minutely asperulate, 9–13×12–16 μ. Teleutospores in mass appearing black; singly, fulvous to dark brown; 30–100 μ, convex at free end, depressed where joined to pedicel, small ones rotund, composed of from 5–30 cuneate cells, their free ends frequently bearing a single hyaline, short spine; cells 18–23×20–30 μ; cystoid cells 5–15, rotund, hyaline or colored, rigid, 14–18 μ; pedicel fulvous, stout, 50 – 80 μ long.— On stems, leaves and pods of Cassia nictitans, Auburn, Ala., *Geo. F. Atkinson;* Starkville, Miss., *S. M. Tracy.*

Frequently there is very little of the fungus on the leaves, it being chiefly caulicolous. Occasionally it is abundant also on the leaves, but the sori are comparatively small. Sometimes all the sori on the leaves contain only uredospores, but again teleutospores as well.

I have had an opportunity of comparing this species with *R. stictica,* Berk. & Br., n. 554 Myc. Univ., *R. glandulæformis* Berk. & Cur., n. 1251 Myc. Univ., and *R. Texanus* Ell. & Galloway.

I have also collected at Auburn, during the month of September, 1891, *R. glandulæformis* B. & C. on *Tephrosia hispidula* and *Virginiana,* and my assistant, Mr. B. M. Duggar, has collected it on *Tephrosia spicata.* The specimens on Tephrosia Virginiana are of interest from the fact that the fungus is very abundant on the stems, the sori being longer and often confluent, presenting much the same appearance to the unaided eye as Ravenelia Cassiæcola on Cassia nictitans.— GEO. F. ATKINSON, *Department of Biology, Ala. Polyt. Inst., Auburn.*

Cleistogamy in Polygonum acre.—Apropos of Mr. Meehan's discovery of cleistogamy in Polygonum, I would record the observation of cleistogamous flowers on the same species, P. acre, at Knoxville, Tenn., on the 24th of September. For the accompanying illustrations, showing the appearance of plants in question, I am indebted to Prof. Scribner. I have searched for cleistogamic flowers on other species of Polygonum, but without success.— T. H. KEARNEY, JR., *University of Tennessee.*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Mutilation of the flower of Tecoma radicans.— During the past twenty years I have frequently found flowers of our common Trumpet

Vine split at the lower portion of the tube; the slit usually extending through the upper two-thirds of the calyx, the lower portion of the corolla-tube and down to the nectary. All this time I have been on the lookout for the author of these depredations, and only during the past month have I been successful in detecting him at his work.

For several years my suspicion has been resting on *Icterus baltimore*, for I have on a number of occasions seen him fly from a clump of these flowers in such a manner as to make me believe he had been at work on them; but I did not wish to whisper such a report about a bird of such an unusual beauty, unless I knew it to be true. But several weeks since, while sitting concealed by a window, which is within a few feet of a thrifty Trumpet Vine, then in full bloom, I detected a pair of Baltimore Orioles in the act of slitting the flowers as above described and taking the nectar; since then this observation has been repeated several times.—JACOB SCHNECK, *Mt. Carmel, Ill.*

EDITORIAL.

AT THE Washington meeting of the American Association notice was given of an amendment to divide the Section of Biology. Of course this means to separate the zoologists and botanists; and as the matter will be up for discussion and decision at the next meeting, it is just as well for botanists to begin considering its advisability. The notice of amendment was prompted by two considerations: (1) The extremely crowded program, which compelled the cutting down and mutilation of some of the most important zoological and botanical papers, and also entirely prevented in many cases the presentation of papers by some of our most distinguished biologists. (2) The numerous technical papers in each biological division which were unintelligible to the other. The first consideration may possibly be weakened by the fact that there was, at Washington, a conjunction of an unusually large attendance of biologists and an unusually short allowance of time for reading papers. But three days were allowed, four being the usual number. However, the attendance will be more likely to increase than to diminish, and the working days of the association will probably remain those of the Washington meeting. The second consideration is also an important one, for with the reading of every paper it becomes very apparent that "one-half the world doesn't care how the other half lives." Upon the whole, the GAZETTE is now inclined to favor the amendment, providing such a division will not diminish the interest of the Botanical Club, an exceedingly valuable organization, and one whose informal meetings cannot be duplicated by a Botanical Section of the Association. Even if the division into botanical and zoological sections be made, it will always be desirable to have certain papers of general biological interest read in joint session, a thing commonly provided for in other sections.

CURRENT LITERATURE.

Saccardo's Sylloge Fungorum.

The enumeration and description of all known fungi, a work of enormous magnitude, was begun a decade or more ago by Prof. P. A. Saccardo, of Padua, Italy. The first volume appeared in 1882, and the eighth and last of the regular enumeration two years ago. The eight, thick, royal octavo volumes contained the description of 31,927 species.

It was to be expected that some species would be overlooked, and that new ones would be constantly added, so that the work is no sooner finished than it needs a supplement. The first number of such a supplement is already issued, and botanists will feel under a special debt of gratitude to the author for the promptness with which it has been prepared.

The *Supplementum Universale* is to consist of two volumes, the first of which bears date of September, 1891, and the second is promised for 1892. The present volume [1] is as thick as the thickest of those which have preceded, and contains descriptions of 4463 species, distributed among six large groups, as follows: Hymenomyceteæ 1083, Gasteromyceteæ 72, Hypodermeæ (Ustilagineæ and Uredineæ) 249, Phycomyceteæ 139, Pyrenomyceteæ 2903, and Laboulbeniaceæ 17.

The volumes containing the Pyrenomyceteæ were issued in 1882–3, which partly accounts for the great preponderance of species in that group. The Laboulbeniaceæ appeared in the final volume, 1889, with only 15 species, and the 17 additions of the supplement were all derived from the two publications of Dr. Roland Thaxter, and are all American. Thus the largest and earliest published group shows an increase of 47 per cent., and the smallest and latest published group shows an increase of 113 per cent. Even if we take into view the rusts and smuts, which are among the best worked of the fungi, and which show 8 per cent. increase since the volume on that group came out three years ago, the rate at which new species are published is almost appalling, and makes a work like the present well-nigh indispensable.

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[1] SACCARDO, P. A.—Sylloge fungorum omnium hucusque cognitorum: Vol. IX, Supplementum universale, Pars I. pp. 1141. Roy. 8vo. Padova. 1891.—fr. 57.

A book for children.

The books which are adapted to stimulate the interest of children in the plant-world are few enough, when all are enumerated, and those that are even tolerable can be counted on the fingers of one hand. It is with much pleasure therefore that we welcome another,[1] for it belongs distinctly to the better class. Mrs. Bergen has very happily named her little book "Glimpses at the Plant World," and they are surely enticing glimpses which ought to engender a desire for fuller knowledge. In thirteen chapters of five or six pages each the author describes engagingly the different types of plants, yeast, moulds, toadstools, lichens, fresh-water and marine algæ, mosses, ferns and flowering plants. The remaining chapters, about as many more, deal with the fertilization of flowers and the methods of seed distribution, topics which are in their nature attractive and are here made so for children.

Mrs. Bergen's style in this book is easy, in places colloquial, and what is of much greater importance the statements which she makes are not only well put but correct. We recall none that is absolutely incorrect andvery few that one would even wish changed on account of possible misconception. The publishers have given the little book a tasteful dress, but some of the illustrations are open to criticism; such as that of diatoms (?) on page 38, which is only a three inch black circle, with a few scratches in it. The text deserves the best and most artistic work.

A collector's guide.

A new guide for collectors of phanerogams appears from the hand of Professor Penhallow.[2] It contains concise directions for the collection and drying and mounting of phanerogams chiefly, though enough reference is made to the mosses to urge objections against the use of half-size sheets for such smaller plants, objections which appear weighty to the author, we venture to say, only because he never tried the small paper. We note also that standard paper is given as 11×17 inches. which does not quite agree with that most used on this side of the boundary. An appendix shows samples of labels, of mounting and drying paper, genus covers and pockets "for seeds and mosses." (There is a much better form for mosses, by the way.) On the whole the directions are excellent, clear and simple, and in the neat form given them by the publisher, come just at the right time to help along the *renaissance* in collecting to be wrought by the Botanical Club of Canada.

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[1] BERGEN, FANNIE D.—Glimpses at the plant-world. 16mo. pp. vi. 156. Boston: Lee & Shepard. 1892. [*sic.*]

[2] PENHALLOW, D. P.—The botanical collector's guide: a manual for students and collectors; containing directions for the collection and preservation of plants and the formation of a herbarium. 16mo. pp. 125. figs 8. Montreal: E. M. Renouf. 1891.—75 cents.

OPEN LETTERS.

Nomenclature from the practical standpoint.

There is one point in this matter of botanical nomenclature on which, with all due respect, very many writers on the subject seem to have gone astray. It has been assumed that there is no reason why botanical nomenclature should not follow the same rules as zoological nomenclature, and hence the priority of names can be as rigidly maintained in the former as in the latter system. This may be very well in theory, but in practice the cases are very different. In zoology generally the scientific names are not in common use outside of scientific circles, while in botany they are. This difference is owing not only to the greater popularity of the latter science, but to the great development of horticulture among the people. In consequence the Latin generic and specific names of plants are used almost as often as some English equivalent, and in many cases to the entire exclusion of so called "common names." This being the case the attempt of certain botanists to change well known names of plants for no other reason save to carry out their own pet theory of nomenclature is almost as hopeless from a practical point of view as an attempt to revise and change the common names of plants in accordance with the individual taste of a certain school of botanists. The nomenclature of a science is not necessarily so much a part of the science that only scientific men can pass on it. Accepted usage has its rights, and generally maintains them whether in accord with theory or not.

A more analogous case, it seems to me, is that of geographical nomenclature. Here also popular usage is a factor, and at once the folly of trying to lay down strict, inviolable rules becomes apparent. Time and time again have the good old historical names been supplanted by names of modern origin, and it would be well nigh useless to make even an attempt to restore them unless the attempt is to be made by authority of the government, not of the individual. Just here appears one of the weakest points of the "strict priority rule" of botanical nomenclature — that it is the creation of the individual, not only unsupported by such governmental botanical authority as we possess, but directly opposed to it in many important particulars. In other words, individual opinion tries to oppose such botanical consensus as we now have in order to carry out its own private theory.

The right of the people to well known botanical names in common use is not likely to obtain much consideration from the herbarium botanist, neither is the application of a statute of limitations to fix definitely the acceptance of such names, yet there is good legal analogy for such a method of treatment, and it would be the business-like and the most familiar way to deal with the subject from a practical standpoint. The advocates of the "strict priority rule" no doubt started with the best intentions and after much careful consideration, but it now seems as if they regarded more the framing and enforcement of an easy rule to follow than a practical rule to secure the most good. Surely their attempts to simplify botanical nomenclature have not given us much relief as yet, and in very many cases show more the ill-directed zeal of the pedant, than the calm, deliberate, common sense judgment of the master. In their attempt to suppress individual dictation in specific cases they claim for themselves the right to dictate the acceptance of a rule that many of us are far from being convinced is the only rule to be followed. We must take the *ipse dixit* dose at the outset instead of later: that is all! Moreover recent events show that this rule, like any rule based on historical facts, does admit of difference of opinion in specific cases, the very evil, I judge, they sought to avoid. Altogether the present condition of botanical nomenclature shows the usual result of allowing theorists to deal with practical matters; for I maintain most stoutly that botanical nomenclature is a living, practical, popular question, and deserves to receive common sense, business-like treatment where there is need of it.

What I have said applies only of course to the so-called "strict priority rule," that extreme, that hard-and-fast rule which enforces priority without exception, reasonable or unreasonable. That priority furnishes a sound foundation for a satisfactory system of nomenclature seems to me beyond dispute, and the work that is being done in many directions is most useful and helpful. When, however, the application of the rule becomes more an object than the avoidance of confusion, when the digging up of long dead, often still-born names becomes of more importance than the retention of names well known and for years accepted by both popular and scientific usage, then many of us feel that temperance is indeed a virtue in questions of botanical nomenclature as well as in other matters of life. Let us at least wait for the action of a Botanical Congress possessing authority, before we accept the tyranny of a rule that knows no exception, listens to no reason, and claims for itself with very little justice, the inviolability of a natural law.— EDWARD L. RAND, *Boston, Mass.*

NOTES AND NEWS.

DR. A. W. SCHIMPER, of Bonn, has declined a call to the University of Marburg on account of his health.

OUR ATTENTION has just been called to a misleading error on page 199 which escaped correction in the proof. In line 16 from the bottom *Pirus* should read **Pinus**.

MR. FRANCIS DARWIN's address, as President of the Biological Section of the British Association, was upon "Growth-curvatures in plants."

A NEW "Old-man Cactus," from Lower California, is figured and described by C. R. Orcutt in *Garden and Forest* (Sept. 16). It bears the name of Cereus Sargentianus.

IN EXPERIMENTING upon the climatic conditions for the development of nicotine in tobacco plants, Mr. A. Mayer concludes that increase of heat, light and atmospheric moisture all increase the percentage of this alkaloid.

THE *American Journal of Science* has begun an interesting series of papers, by Dr. George L. Goodale, describing the museums and botanical gardens in the equatorial belt and in the South Seas, which the author recently visited.

IN THE FIRST report of the Sugar-cane experiment station in West Java, W. Krüger has a paper on the diseases and enemies of sugar-cane, which would probably be of value to some of our southern stations. It is published by G. Schönfeld, Dresden.

THE FERNS collected during the past three years in Mexico by Mr. Pringle are being enumerated by Mr. George E. Davenport in *Garden and Forest.* The new species described in the first two parts are Asplenium Pringlei (Sept. 23), A. dubiosum and Hemionitis elegans (Oct. 14). The first and last are figured.

BEYERINCK has proposed[1] a neat test for the excretion of acids by bacteria. He adds to the nutrient medium enough finely divided chalk to make it milky white and opaque. On growing acid-forming microbes in such a medium the colonies of these will render the opaque medium transparent in their vicinity, owing to the solution of the carbonate.

THE *Journal of Mycology* is making itself more and more useful to mycologists, both those of the experiment stations and those who can study mycology for its own sake. Vol. VII, no. 1, issued Sept. 10, marks a new epoch, as it becomes with this new volume the organ of a Division of the Department of Agriculture, and not simply of a section of the Botanical Division.

VINES OBJECTS to Wortmann's view (see this journal xv. 346) that green leaves contain no diastase or only such a small quantity that it is insufficient to account for the transformation of the starch they manufacture into sugar. He has re-investigated the subject and his recent experiments point to the same conclusions as the earlier ones of Baranetzky and Brasse, namely, that there is diastase present in green leaves, and that it does convert the starch into a sugar.

MR. T. S. BRANDEGEE has just published a paper on the "Flora of the Cape Region of Baja California." This very interesting region, known until recently only from the Sulphur and Xantus collections, is being thoroughly investigated by Mr. Brandegee, and also by the Botanical Division of the Department of Agriculture. The present paper brings the scattered material together, 179 species being enumerated, 29 of which are new.

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[1] Centralb. f. Bakt. 9. 781.

A RUST of carnation pinks (*Uromyces caryophyllinus* Schrœt.) has appeared in several places in Indiana, and threatens to be a serious pest to florists. It was brought to the attention of Dr. J. C. Arthur the middle of last month, and investigations show that it is already well distributed in the state, some large greenhouses not having a plant free from it. It has long been known in Germany and southern Europe, but this is believed to be the first time it has been reported in this country.

PROF. LUCIEN M. UNDERWOOD, of DePauw University, Greencastle, Ind., has decided to devote his time exclusively to botany, and offers his entomological library for sale. It contains sets, mostly complete, of American serial publications, the nine Missouri reports by Riley, bound in 2 vols., with index; Fitch's fourteen reports bound in 3 vols., with MS. index; Löw & Osten Sacken's Diptera complete, and many other rare and valuable works. It also includes the nearly complete literature on N. A. Arachnida.

THE ORCUTT Seed and Plant Co., San Diego, Calif., announce the preparation of herbarium specimens of all cultivated plants, which they intend to test at San Diego. The labels will give botanical and vernacular names, descriptions drawn from the fresh plant, color, historical, economic and cultural notes. It is hoped that botanists and horticulturists will lend assistance to the work, as cultivated plants are generally neglected in herbaria.

THE ROYAL Danish Academy of Sciences at Copenhagen offers two prizes of 400 and 600 kronen, respectively, (a) for investigations on the sorts and proportions of the more important carbohydrates present at different stages of ripeness of the four chief cereals; and (b) for investigations of the Phytoptus galls which are found in Denmark with a monographic treatment of the species of the genus of insects producing them. The latter investigation is desired especially to clear up the question as to whether on the same species of plant a given species of Phytoptus may produce different galls at different stages of its development. The prizes are to be awarded in October, 1893.

SOME RECENT researches by Drs. Frank and Otto, of Berlin, have shown that the green leaves of plants are at evening richer in nitrogen than in the morning, and that the leaves themselves show an accumulation of nitrogen, when they are separated from the plant, placed in water and exposed to the direct sunlight. These investigators deduce from their results some conclusions as to the harvesting of plants for fodder (such as clover) which need testing on a practical scale. They recommend the cutting of clover late in the day, preferably toward sunset of a warm, clear day, in order that the greatest amount of the nitrogenous foods, which have the highest nutritive value, may be secured.

IWANOWSKY AND POLOFZOFF describe in the Mémoirs of the St. Petersburg Academy (VII. xxvii. n. 7) a spot disease of tobacco, caused by a deficient supply of water, which may be occasioned either by a poor development of the root system owing to a lack of potash in the soil, or to lack of moisture in the soil owing to poor cultivation. The spots appear on the lower leaves first, and spread to the upper. They are of very different form and size, frequently enlarge and fuse, and sometimes the tissue involved breaks away entirely. The whole mischief is often wrought in two or three days. Is not the plant subject to the same trouble in this country? Better tillage, selection of ground, with proper exposure and rotation of crops are advised.

THE STUDY of the peach yellows has been a most discouraging task' but Mr. Erwin F. Smith, who has for several years been at work upon the disease for the Department of Agriculture, has shown great perseverance in its investigation. In an address before the Peninsula Horticultural Society at Easton, Md., he asserts that the disease on that peninsula is increasing, and that he has definitely ascertained by inoculation experiments that the disease is contagious. No preventive measures or treatment have been able to check it in the least. In Michgan, however, the eradication of every diseased tree has practically suppressed the trouble, and this is recommended to the Delaware and Maryland growers. While several organisms have been found associated with the diseased tissues, none has yet been proved to be the cause of the malady.

THE LAST PART of *Pittonia* (Vol. II., part 10), just issued, is an interesting one, as all the parts are. Of course numerous new species are described. Achætogeron is included under Erigeron and its species properly renamed. The most interesting part is always that which deals with ancient names of genera, as one never knows what unheard of name is to be suggested for his old friends. In the present paper 9 genera are thus treated and their 79 species renamed. *Polanisia* is changed to *Jacksonia* Raf., *Wistaria* to *Kraunhia* Raf., *Riddellia to Psilostrophe* DC., *Troximon* to *Agoseris* Raf., *Pyrrhopappus* to *Sitilias* Raf., *Cordylanthus* to *Adenostegia* Benth., *Echinospermum* to *Lappula* Mœnch., *Microstylis* to *Achroanthes* Raf., and *Symplocarpus* to *Spathyema* Raf. A new and promising field of nomenclature is opened up in the case of revertible names. No genus is now to be allowed to bear a revertible name (that is one that appears as the more ancient synonym of any other genus). Accordingly, simply by way of mentioning "but a few out of many changes" which are promised, the author proceeds to coin generic names. *Pickeringia* Nutt. is renamed *Xylothermia; Nuttallia* T. & G. is *Osmaronia; Darlingtonia* Torr. is *Chrysamphora; Crantzia* Nutt. is *Lilæopsis; Rafinesquia* Nutt. is *Nemoseris; Torreya* (used with 5 genera) is *Tumion* (this time of Raf.). In the same part, Professor Greene replies to the criticisms that have been made of his citation of ancient botanical authors, and also inveighs against the Negundo Negundo and Catalpa Catalpa departure in nomenclature.

Published by Theodor Fischer, Cassel, Germany.

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Edited by

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VOL. XVI. DECEMBER, 1891. NO. 12.

THE BOTANICAL GAZETTE

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[ISSUED DECEMBER 15.]

CRAWFORDSVILLE, INDIANA.
PUBLISHED BY THE EDITORS.

Tracy, Gibbs & Co., Printers, Madison, Wisconsin.

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On the relationships of the Archegoniata.[1]

DOUGLAS HOUGHTON CAMPBELL.

Under the name of Archegoniata are usually included the bryophytes and pteridophytes, but we may also include with them the gymnosperms, as all three groups agree in the presence of an unmistakable archegonium, which while differing in some details has such similarity of structure as to point to an almost certain, although remote, common origin for all three groups.

This homology was first shown by Hofmeister[2] in his remarkable series of investigations upon the higher cryptogams and gymnosperms, and has since been the subject of numerous investigations, so that a great mass of material has accumulated.

Numerous attempts have, of course, been made to trace out the inter-relationships of these groups; but recently a good many new facts have been discovered which may throw a somewhat different light upon these, and it is the intention here to call attention to these, and attempt to point out what their bearing is upon the point in question. In trying to do this, the data assumed are mainly derived from the results of a developmental study of the different forms, coupled with such evidence as the palæontological record has to show. Unfortunately the latter is too fragmentary, as regards the lower forms and the more delicate parts of the higher ones, to be of very much service in the study of these points; still very valuable material has been brought to light, and probably much more will be discovered if a systematic search is made.

It is generally admitted that we are to look for the ancestors of the higher plants among the fresh water green Algæ. On account of the structure of the sexual organs, as well as the occurrence of a sort of protonema, the Characeæ have sometimes been regarded as the nearest approach among existing Algæ to the mosses; but if this is so, the ancestral forms must have been of a much less specialized character than even the simplest of living forms, and it seems more probable that of living Algæ, the higher Confervaceæ such as *Coleochæte*, come nearer to this hypothetical form.

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[1] Read before Section F, A. A. A. S., Washington Meeting, August, 1891.

[2] The higher Cryptogamia.

The first of the groups with which we have to deal, the Bryophyta, or Muscineæ, is readily divisible into two classes, the liverworts (Hepaticæ), and true mosses (Musci). There has been some controversy as to which of these is nearest the primitive stock, and to the higher plants. A comparison of the two groups will show, however, very strong reasons for considering the Hepaticæ as the more primitive group. Although far outnumbered in species by the true mosses, the Hepaticæ show a much greater diversity of form, both of the gametophyte and sporophyte than is the case with the Musci, which form a remarkably close group with relatively insignificant differences (excepting in the case of *Sphagnum*); and the higher ones, with their very peculiar and highly specialized sporogonium, are evidently very remote from any other group of plants. The Hepaticæ, on the other hand, offer a very strong contrast to this. Several divergent stocks are evident, all traceable to a common form and touching in certain respects, Algæ, Musci, and Pteridophyta. The thallus of such simply organized forms as *Anthoceros* or *Pellia*, is but a slight advance on the higher green Algæ, although it must be borne in mind that this simplicity does not extend to the sexual organs and sporophyte. On the other hand, these same forms are connected directly with the Musci through *Sphagnum*, and as the writer has endeavored to show before,[1] to such pteridophytes as *Ophioglossum*.

If we now study a little more closely the relation of the Hepaticæ, *inter se*, we can distinguish three well-marked series of forms diverging from a common stock. Nearly all liverworts pass through a more or less well-marked thallose stage which is persistent in some of the simpler thallose Jungermanniaceæ such as *Aneura* and *Metzgeria*. This is a simple flat often heart-shaped thallus, growing from a single apical cell. It is usually, although not always, traversed by a well-marked mid-rib. The frequent recurrence of this stage in the development of so many forms of Hepaticæ, as well as in the prothallium of the isosporous ferns, is most readily explained by the assumption that this represents the ancestral type from which both groups have sprung. Granting this to be the case, the thallose Jungermanniaceæ are to be regarded as the most primitive of living forms, and not the Ricciaceæ, which are usually so considered. It seems more likely that the latter, together with the very closely related Marchantiaceæ, represent a group in which the thallus has become highly differentiated, without a corresponding development of the sporophyte, and which reaches its highest expression in such forms as *Marchantia* and *Asterella.* Of course it is possible to regard the simpler Ricciaceæ as the primitive forms from which the Jungermanniaceæ have sprung; but this would involve a reduction of the thallus in the latter which seems hardly probable, as in some Marchantiaceæ, and probably in the Ricciaceæ also, the young thallus corresponds closely to to that of the simpler Jungermanniaceæ, and the massive thallus of the older plant arises secondarily. The very simple sporogonium of *Riccia*, of course, is an important point in determining its systematic position, and indicates, that if, as here suggested, the Ricciaceæ are derived from forms like the lower Jungermanniaceæ, it must have been at a very early period, before the sporogonium of the latter had reached its present stage of development.

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[1] The affinities of the Filicineæ: Bot. Gaz. Jan., 1890.

Leitgeb[1] has already called attention to the connection of *Anthoceros* with the Jungermanniaceæ, and the evolution of the foliose forms of the latter group from the thallose forms is easily demonstrated.

We may then pretty safely assume that the primitive liverworts were thallose forms not unlike such existing forms as *Metzgeria*, or the prothallium of an *Osmunda*, and that from these, three stocks diverged, the Ricciaceæ (including Marchantiaceæ), the Anthoceroteæ, and the foliose Jungermanniaceæ. The first and third of these groups forming the great bulk of the living forms are to be regarded as specialized branches that end blindly; the second, however, is especially important from a morphological standpoint, as it probably represents to a considerable degree, the ancestral form from which both the true mosses and the Pteridophytes have sprung.

The Anthoceroteæ[2] differ remarkably from the other liverworts, especially in the development of the highly specialized sporogonium. This finds its nearest homologue, not among the Hepaticæ, but in the lowest order of the true mosses, viz.:

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[1] Untersuchungen über die Lebermoose, Vol. V, pp. 8–9.

[2] Leitgeb, l. c.

the Sphagnaceæ. The close similarity in the development of the sporogonium in these two groups, can only be explained on the assumption of a common origin, and this is strengthened by the fact that the protonema of *Sphagnum* is a large, flat thallus instead of the filamentous form common to most mosses. In short, *Sphagnum* forms a link between *Anthoceros* and the true mosses.

This is true of the protonema, as well as the sporogonium, for while the younger protonema is at first a simple flat thallus, later there may grow out from its margin filaments which have all the characters of the ordinary protonemal branches of the higher mosses, including their peculiar oblique septa. These filamentous branches, as well as the leafy stem, are secondary, and it is difficult to see how we can assume that the former represents the primitive condition, as Goebel[1] and Bower[2] assert. It seems much more in accordance with the facts to believe that the flat thallus represents the primitive form of all, and that in the mosses, as the leafy branches bearing the sexual organs became more and more prominent, the large prothallium-like protonema gradually became lost, being replaced by the secondary filamentous form found in most mosses.

The foregoing attempt to point out the connection of the different groups of the bryophytes may be illustrated by the diagram on the opposite page.

The probable connection of the Anthoceroteæ with the Filicineæ has been noted by several investigators,[3] but the assumption has been usually made that the relationship must be sought with the Leptosporangiatæ, as these have been regarded as the lowest of the forms. Of the leptosporangiates the Hymenophyllaceæ have usually been regarded as the most primitive, this opinion being based mainly upon the delicate character of the sporophyte. The most recent investigations, however, do not bear this out, and the attempt of Prantl[4] to homologize the sporogonium of *Anthoceros* with the sporophyte of *Hymenophyllum* involves such an amount of pure speculation and so little real morphological correspondence as to be very far from convincing.

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[1] Morphologische u. biologische Studien: Ann. du Jardin botanique de Buitenzorg, Vol. VII, p. 115.

[2] Annals of Botany, Vol. III, No. 11, p. 372.

[3] Leitgeb, l. c., Vol. VI, p. 60.—Prantl, Hymenophyllaceæ, p. 62.

[4] L. c., p. 62.

From a very careful study of the question, the writer[1] was led to a very different view as to the relative position of the different groups of the Filicineæ, and gave what seemed to him strong evidence in favor of considering the eusporangiate forms, which hitherto were regarded as the highest of the ferns, as the primitive forms from which the Leptosporangiatæ have been derived. Ophioglossum was considered to be the nearest of the existing forms to this ancestral form, so far as can be judged from a study of the structure of the sporophyte.

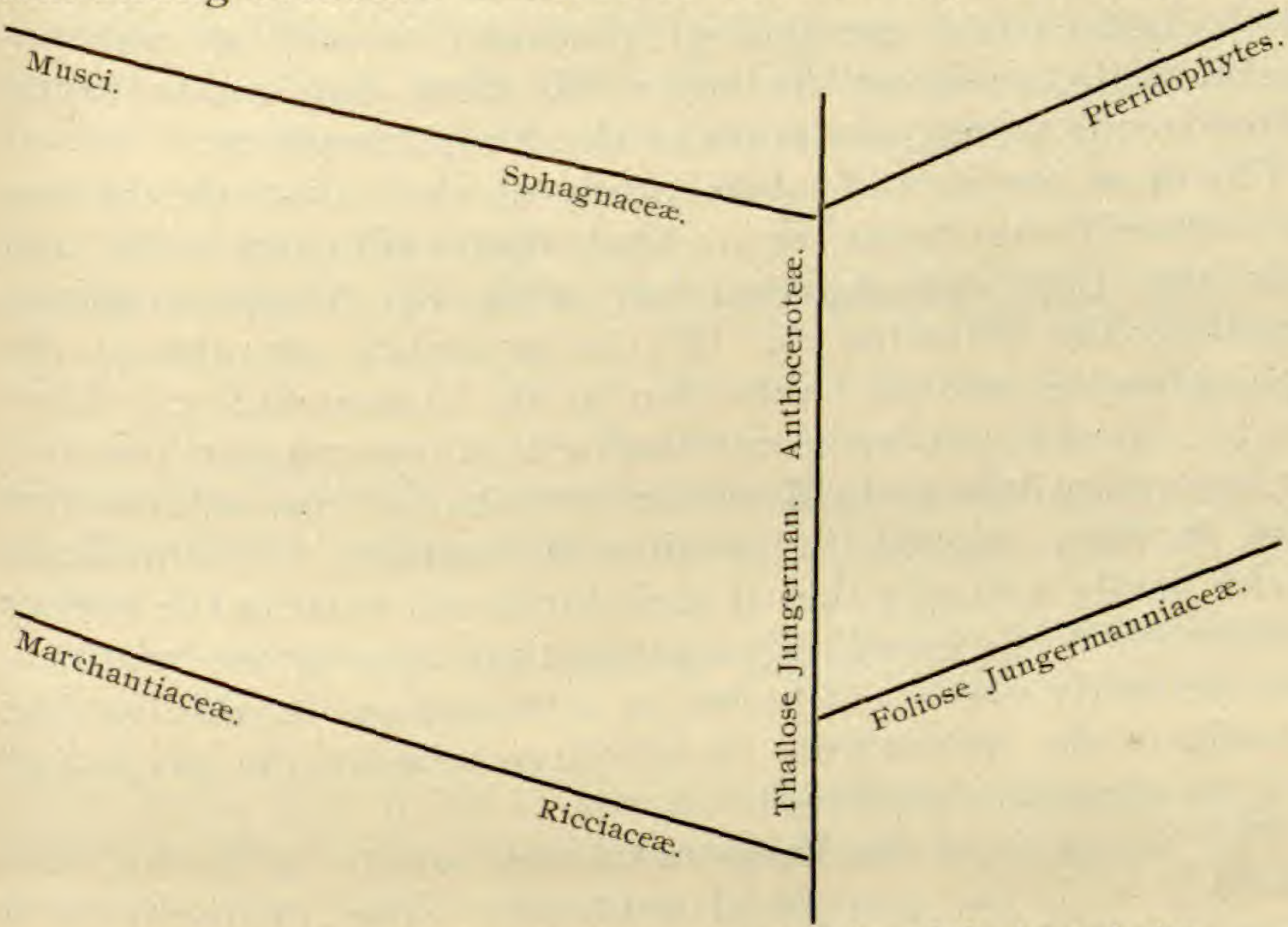

DIAGRAM 1, illustrating the inter-relationships of the bryophytes.

Of the three classes of the pteridophytes, the ferns form a very large majority and constitute the prevailing type of the existing forms. If we compare the number of species in the three classes, we shall find that the Filicineæ comprise at least 90 per cent. of living forms, and that of the 3000 or more species of ferns an overwhelming majority belong to one family—the Polypodiaceæ. This fact, in connection with the highly differentiated sporangium, and other structural peculiarities, led me to express the opinion that the Leptosporangiatæ (of which the Polypodiaceæ are the type), instead of representing the primitive group of ferns, were in fact a comparatively modern, specialized group, comparable to the leafy liverworts or the true mosses. There is no geological evidence to show that the true leptosporangiate ferns were ever much more numerous or better developed than at the present time. On the other hand, the geological record, as well as embryological study, so far as the latter has been applied to them, points to the primitive nature of the Eusporangiatæ.

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[1] Affinities of the Filicineæ, p. 3.

The most recent and careful study of the carboniferous and pre-carboniferous ferns, show that their affinities were not with the Leptosporangiatæ, but with the Eusporangiatæ, especially the Marattiaceæ. Forms probably referable to the Ophioglosseæ, and probably also to the Osmundaceæ,[1] have also been found, but no unmistakable leptosporangiate remains are known until the early Mesozoic formations, from which time they increase rapidly in number and variety. Solms-Laubach[3] justly remarks that if such forms did exist in the earlier formations, it is exceedingly strange that, among the innumerable perfectly preserved leaves, a structure so durable as the annulus of the sporangium should have failed to be preserved in a recognizable condition.

The ontogeny of the Eusporangiates, so far as known, harmonizes with the geological evidence. The prothallium is more massive, and longer-lived than in the leptosporangiates, in this respect approaching the liverworts, and the sexual organs show points of primitive structure. Unfortunately the embryogeny is scarcely at all known in any of the homosporous forms, which are presumably the most primitive and approach most nearly the ancestral type.

From a series of investigations recently completed by the writer, it appears that the Osmundaceæ are about midway between the true Eusporangiatæ and the Leptosporangiatæ, both in regard to the prothallium and the embryo. The intermediate character of the tissues of the sporophyte has already been repeatedly called attention to by various writers. The prothallium resembles to a remarkable degree that of certain liverworts, notably *Dendroceros*, and the sexual organs approach in certain respects the Marattiaceæ, but also recall *Equisetum* and even certain bryophytes. The embryo is noticeable on account of the large size of the foot and its long dependence upon the prothallium, as well as the great development of the calyptra, all of which are evidences of the primitive character of the group, and in all of which, so far as known, it approaches the Eusporangiatæ. An interesting point noted was the fact that the primary root grows from a single tetrahedral apical cell, as in all of the Filicineæ except the Marattiaceæ and *Isoetes*, while the later roots, at least of the two species studied, *O. Claytoniana* and *O. cinnamomea*, possess a four-sided pyramidal apical cell. This seems to indicate that the former is the primitive form which has been retained in all except the Marattiaceæ and the probably allied *Isoetes*. Whether this state of things obtains in the embryo of the former of these is not known, but it is not impossible; in the latter a trace of this is sometimes seen in the very earliest stages of the embryo, but is lost before the root is fully grown.[1]

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[1] Solms-Laubach: Palæophytologie, p. 156.
[2] Bower: Annals of Botany, May, 1891.
[3] L. c., p. 156.

In the course of these investigations points of resemblance, both in the prothallium and sexual organs were noted, that recalled the corresponding points in *Equisetum*. So numerous were these, that it led to a belief of a nearer relationship between the Equisetineæ and Filicineæ than is usually maintained, and to warrant the possible union of the two classes into a group opposed to the Lycopodineæ. Van Tieghem[2] has called attention to correspondences in the sporophytes of *Equisetum* and *Ophioglossum* which confirm this view. It is even possible that this might be carried so far as to assume a common origin for these two classes, distinct from that of the Lycopodineæ which in some respects recall rather the true mosses than the liverworts. One great difficulty in dealing with the Lycopodineæ, and especially the Equisetineæ, is that they are degenerate forms which have lingered after their larger and better organized kindred have disappeared, and it is difficult to judge which are primitive and which secondary characters. Certain it is, that the investigated species of *Lycopodium*[3] differ more from *Equisetum*, than does the latter from the homosporous Filicineæ. Still we are not yet in a position to speak positively on this point.

Of the true leptosporangiate ferns, the reasons already given seem to warrant the assumption that in the Polypodiaceæ we have to do with a group of comparatively modern forms that have arisen from the more ancient Eusporangiatæ through the Osmundaceæ, Gleicheniaceæ and Cyatheaceæ, which families constitute a quite natural series. The two families, Hymenophyllaceæ and Schizæaceæ, while evidently connected with the lower members of this series, seem to form two offshoots from the main line of ascent, and the former is probably a degenerate group whose peculiarities are largely due to the effects of environment. The affinities of the Hymenophyllaceæ seem to be with the Gleicheniaceæ and Osmundaceæ. The form of the sporangium and spores, as well as the prothallium and sexual organs, is of the type found in these groups. The branching filamentous prothallium, upon the importance of which too much stress has been laid, is by no means rare in *Osmunda Claytoniana* under certain circumstances, and the form of the sexual organs is very similar.

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[1] Campbell: Annals of Botany, Vol. V, No. 19, p. 243.

[2] Unfortunately the paper was not accessible.

[3] Treub: Études sur les Lycopodiacées, Ann. du Jardin botanique de Buitenzorg, Vols. 4, 5, 7.

As to the sporophyte, the Ophioglosseæ form a natural series with *Ophioglossum* at the bottom, and such species of *Botrychium* as *B. Virginianum* at the top, the latter connecting the group with the Osmundaceæ.

The Marattiaceæ, as might be expected of such ancient forms, show affinities with both the Osmundaceæ and Ophioglosseæ, and may perhaps be regarded as a branch of the original stock that, beginning very far down, reached its maximum development in the Carboniferous era, and then declined. Whether, as suggested by Bower,[1] the spermaphytes have arisen from the same stock, must at present remain conjectural.

The forms hitherto discussed are the so-called isosporous forms. Among the existing pteridophytes, however, are four very distinct groups in which spores of two kinds are found, viz.: Selaginelleæ, Isoeteæ, Marsiliaceæ, and Salviniaceæ. The first of these is evidently enough related to *Lycopodium*, and the third to the Polypodiaceæ; but the affinities of the others are not so clear. The Salviniaceæ, while clearly enough belonging to the Leptosporangiatæ, and related to the lower members of the series, still are so peculiar that it is not easy to decide where they should be placed. Prantl[2] suggests the Hymenophyllaceæ as their nearest allies, and probably either these or the Schizæaceæ are to be so considered. *Isoetes* is even more difficult to place. It is unquestionably the nearest among living pteridophytes to the spermaphytes, but with what group of homosporous ferns it is most nearly related, is hard to say; for while showing evident relationship to several forms, they are in widely separated groups. On the whole, the evidence is in favor of regarding it as nearest the Marattiaceæ; but this is liable to be changed when the embryogeny of the latter is known, and the life history of the Ophioglosseæ. (See diagram 2.)

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[1] Annals of Botany, Vol. III, p. 387.

[2] The Schizæaceæ, p. 153.

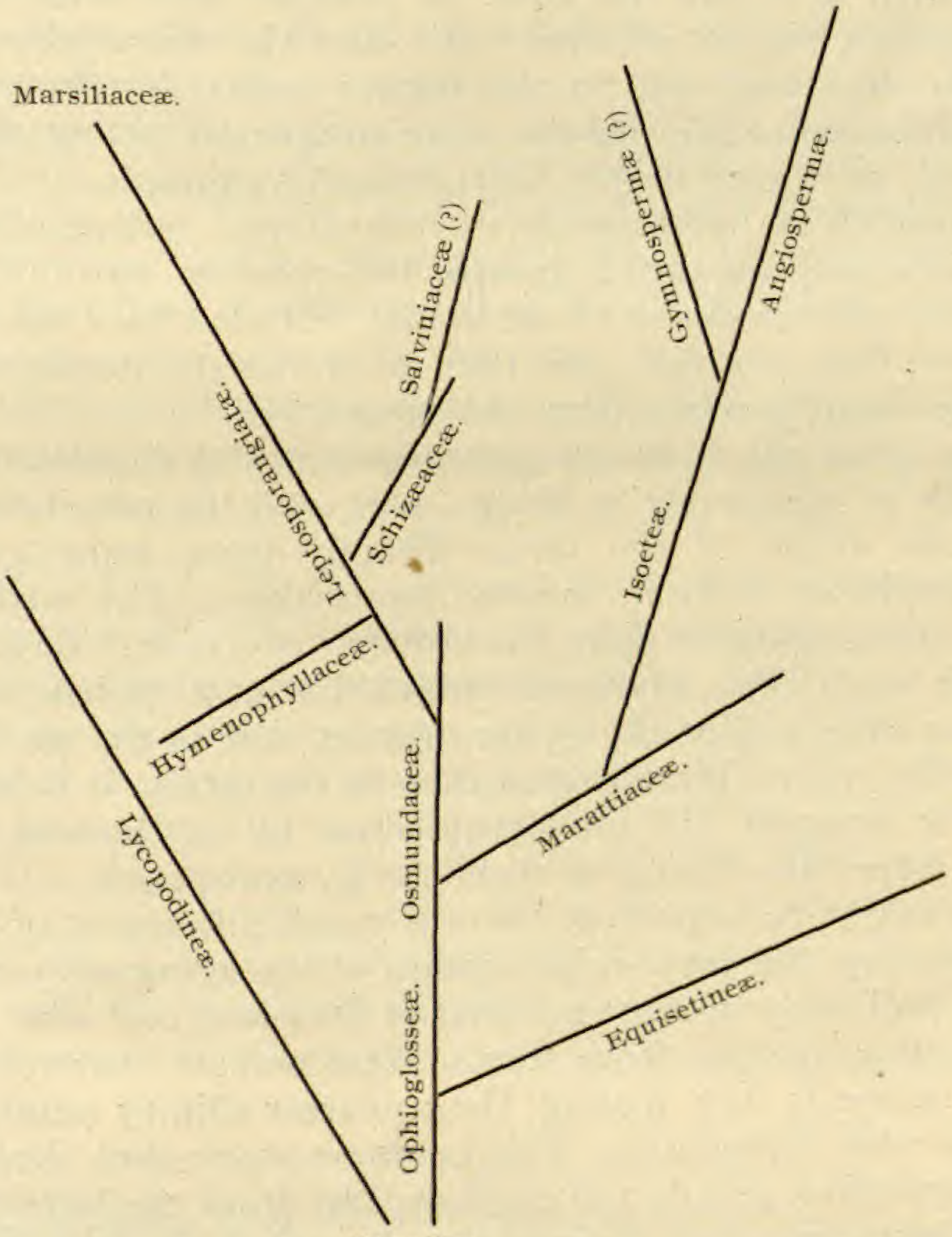
Marsiliaceæ.
Gymnospermæ (?)
Angiospermæ.
Salviniaceæ (?)
Schizæaceæ.
Leptosporangiatæ.
Isoeteæ.
Hymenophyllaceæ.
Osmundaceæ.
Marattiaceæ.
Lycopodineæ.
Ophioglosseæ.
Equisetineæ.
Hepaticæ.

DIAGRAM 2, illustrating the ontogeny of the vascular cryptogams and spermaphytes.

The tendency toward the separation of the sexual organs, occasionally found in nearly all forms examined, occurs regularly in *Equisetum* and many Polypodiaceæ. This tendency has been attended by a greater and greater reduction of the prothallium, which finally, in such forms as *Isoetes*, has lost all power of independent existence, and serves simply to nourish the sporophyte until it can live alone. In these two, the sex of the prothallium is already indicated by the two sorts of spores. This carried a step further resulted in the macrospore being retained permanently within the sporangium which did not separate from the sporophyte until the prothallium was developed.

At first, as is still the case in *Ginkgo*[1] and some cycads, fertilization was not effected until after the sporangium (seed) became detached ; but in the higher forms, fertilization and the formation of the embryo were completed before the seed ripened, as is seen in the Abietineæ, for example.

Inasmuch as heterospory was developed independently in several widely separated groups, the question naturally arises whether the formation of seeds may not also have taken place in more than one line, and that all of the spermaphytes have not necessarily arisen from the same stock.

The great gap between gymnosperms and angiosperms it is at present impossible to bridge over, and the possibility of a separate origin of the latter directly from some group of pteridophytes is by no means improbable. The writer's recent investigations upon the embryo of *Isoetes*[2] have shown that it much more nearly resembles that of a typical monocotyledon than it does the gymnosperms, and as the prothallium is hardly more differentiated than in the latter, it is about as easy to imagine the monocotyledons to be derived directly from forms like *Isoetes* as from the gymnosperms.

As might be expected, there is much difference of opinion concerning the inter-relationships of the spermaphytes. The view ordinarily accepted is that of Strasburger,[3] who derived the gymnosperms from forms intermediate between ferns and lycopods, but having their nearest affinity among living forms with *Selaginella*. This common stock then divided into two branches, cycads and conifers, and from the latter through the Gnetaceæ, were derived the dicotyledons, from which as a degenerate group the monocotyledons have descended.

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[1] Goebel: Outlines, p. 338.

[2] The life history of Isoetes echinospora, Ann. of Bot. Vol. V. No. 19.

[3] Coniferen und Guetaceen, p. 258.

Kny[1] claims a distinct origin for the two divisions of the angiosperms. He says, "The two principal divisions of the angiosperms, dicotyledons and monocotyledons, represent two great independent lines of development, whose origin reaches at least as far back as the vascular cryptogams, if not lower." He is inclined with Strasburger to connect conifers and dicotyledons with the Lycopodineæ, and would derive the monocotyledons directly from the ferns.

Prantl's[2] views are much the same as Kny's, except that possibly a part of the dicotyledons have a common origin with the monocotyledons.

From the evidence at present available, both of embryology and palæontology, the assumption of a separate origin for the two groups of the angiosperms is certainly unwarrantable. In all forms yet investigated, the uniformity in the essential structure of the flowers, and especially the development of the embryo-sac, points unmistakably to a common origin. It may be that further investigations upon the lower members of both groups may modify this view, but that such extraordinary correspondence as exists in the formation of the embryo-sac, the structure of the egg apparatus, the fusion of the endosperm nuclei, etc., could have arisen independently in the two groups is inconceivable.

On the other hand, the evidence for a direct connection of gymnosperms and angiosperms, is not entirely convincing, and the possibility of a separate origin for these two groups is by no means unlikely—nay, seems quite probable.

Whether the origin of the angiosperms is to be looked for directly from the Filicineæ, through such forms as *Isoetes*, or from forms higher up like the cycads, can only be satisfactorily answered after many forms have been thoroughly studied. As yet our knowledge of the embryology of the cycads and the simplest angiosperms is too incomplete to make an answer to this question more than a mere conjecture.

Palo Alto, California.

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[1] Entwickelung der Parkeriaceen, p. 61.

[2] Hymenophyllaceæ, p. 68.

A new herbarium pest.

C. V. RILEY.

In the year 1890 a number of small Geometrid larvæ, recalling somewhat in appearance those of the genus Aplodes, were found by the botanists of the Department of Agriculture infesting certain dried plants in the Department herbarium, and especially those which had been received from Mexico and Lower California, from Dr. Edward Palmer. Dr. J. N. Rose first observed it in January, 1890, on plants from La Paz, but it was still more abundant in a collection from the State of Colonna, Mexico, made in the beginning of the present year. Being referred to me for identification, I became much interested in the matter, as it was the first case that had come under my notice of a Geometrid larva feeding upon dried plants. The matter acquired additional interest also because the species was evidently new and there was danger of its being spread through distribution into other parts of the world. I therefore took steps to watch the course of the insect and rear it to the imago state. This was done some time ago and I have had drawings of the different stages finished for some time, and call attention to the matter now because the trouble has grown in the Department herbarium and it is of sufficient importance to put on record. The first moth emerged October 22d, 1890, and others were subsequently reared from material received from time to time from the Department herbarium. While the larva was first discovered, as stated, on Mexican plants, it has not confined its work to such plants, but has spread to others and is by far the most destructive herbarium pest which the botanists in charge have to deal with. Plants of the genus Coulterella, for example, which were sent by Dr. Rose to Dr. C. Hoffman in Berlin, have been so injured that but one perfect flower remained; yet, according to the observations of Mr. L. H. Dewey, in overhauling the herbarium, the insect's work is still mostly confined to southwestern plants; after these from Mexico, chiefly those from California. In some cases eastern plants have not been attacked, even when associated with western, but in one case at least, viz.: Rhus toxicodendron, eastern plants have been extensively infected.

The larvæ feed on the flowers and also to some extent on the leaves. More rarely they feed on the hard fruits and seeds. The following list, kindly prepared by Mr. Dewey, of the plants upon which the larvæ had been found prior to its work on Rhus toxicodendron will be of interest in this connection.

Species.	*Order.*	*Locality.*
Ptelea aptera	Rutaceæ	S. California.
Ceanothus sorediatus	Rhamnaceæ	S California.
Dalea Seemanii	Leguminosæ	S. California.
Lupinus coccineus	Leguminosæ	Arizona.
Purshia tridentata	Rosaceæ	Arizona.
Prunus demissa	Rosaceæ	S. California.
Ribes viburnifolia	Saxifragaceæ	S. California.
Epilobium angustifolium[1]	Onagraceæ	E. Massachusetts.
Arctostaphyllos oppositifolium	Ericaceæ	S. California.
Eriodictyon glutinosa	Hydrophyllaceæ	Arizona.
Gilia Rusbyi	Polemoniaceæ	Arizona.
Pentstemon secundiflorus	Scrophulariaceæ	Arizona.
Audibertia Clevelandii	Labiatæ	S. California.
Dracocephalum parviflorum	Labiatæ	Arizona.
Salvia ballotæflora	Labiatæ	Arizona.

The eggs are laid upon the plants or on any surrounding object. They are but slightly attached, bluntly ovoid, 0.3 mm. wide and 0.4 mm. long. They are steel-gray in color, the shell white with faint iridescence when empty, and faintly and irregularly reticulate. The duration of the larval period

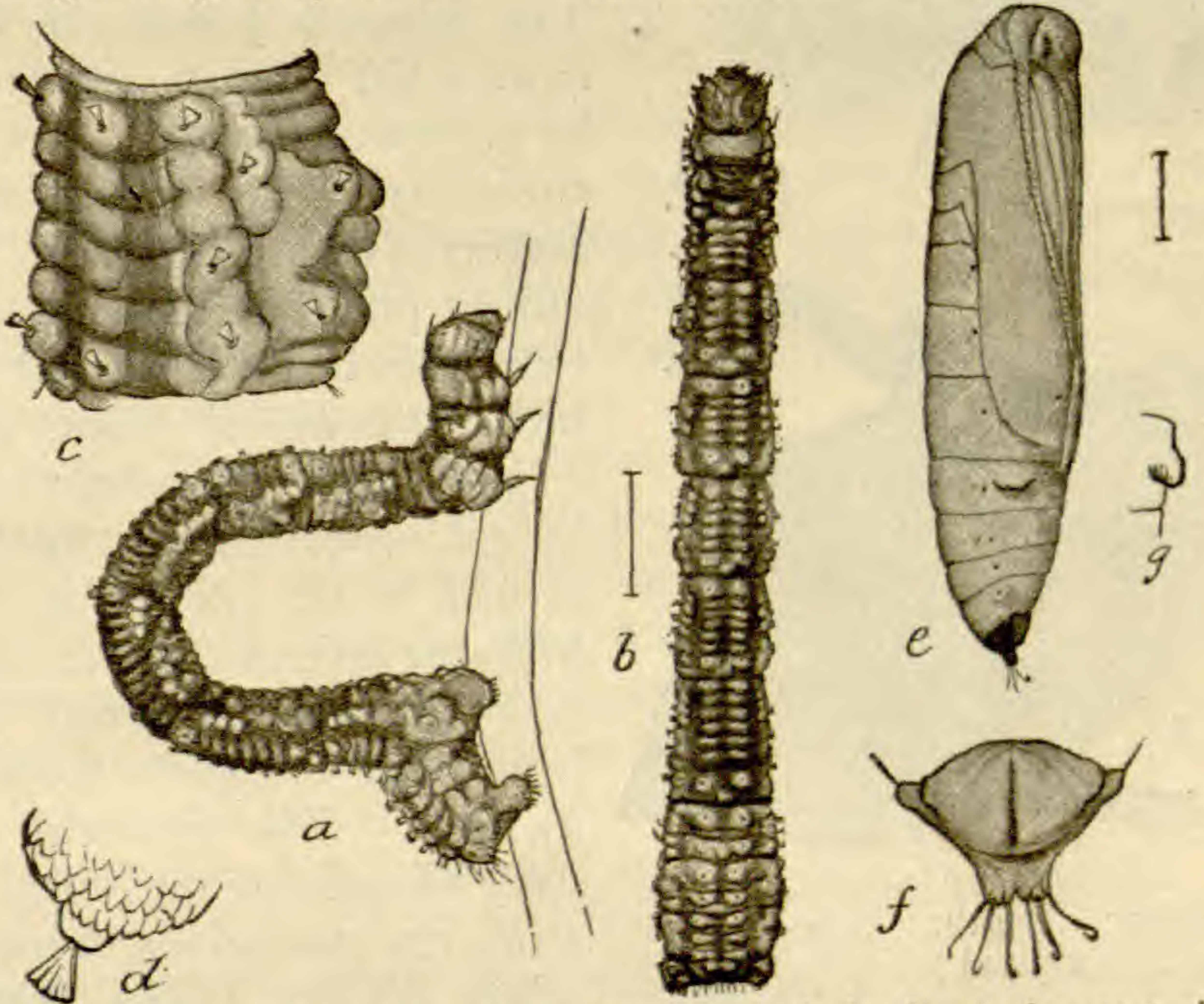

FIG. 1. *Carphoxera ptelearia: a*, larva from side; *b*, do. from above; *c*, side view of abdominal joint of same; *d*, tubercle of same; *e*, pupa; *f*, do. cremaster; *g*, do. abdominal projection.—*a*, *b*, *d*, enlarged about six times; *c*, *d*, *f*, still more enlarged. (Original.)

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[1] E. angustifolium grows in the West but mostly in northern California and Oregon.

has not been determined. Growth, however, is very slow, and the period from the egg to the full larval growth is variable. The larval life extends in some cases certainly over a period of three months. When full grown the larvæ attain a length, extended, of 8 mm.; contracted when disturbed or at rest of 5 to 6 mm. Whenever disturbed they contract considerably and become rigid and motionless. The larva is shown in characteristic positions in the accompanying illustration (fig. 1, *a*, *b*). It is dull grayish in color, varying considerably in different specimens. On reaching full growth the larva constructs a cocoon of loose white silk, forming an irregular open network as shown in fig. 2, *b*. The cocoon is usually placed in a fold of the leaf or is otherwise protected by the plant, and is occasionally partly covered with bits of anthers or fragments of leaves. In shape it is irregularly ovoid and is about 6 mm. by 3.5 mm. The change to pupa takes place about three days after the cocoon is completed and the moth usually appears eighteen to twenty days after pupation. The pupa is 5 mm. in length, somewhat robust, and is slightly yellowish in color, with sutures and tip brownish, the latter being quite dark. A peculiar pad or flap-like projection occurs on the side of the fifth abdominal joint (fig. 1, *e*, *g*). The cremaster is produced, notched at the tip and armed with six long hooked hairs or spines (fig. 1, *f*). The adult insect is about 5 mm. long and expands from 13 to 14 mm. The general color is greyish-yellow inclining to saffron, the primaries being somewhat darker. The wings are marked (fig. 2, *c*) with transverse bands of dusky shade, and each wing has a discal spot. The head is dark brown, with the antennæ, including a large spot on the vertex, yellowish. The under surface is nearly concolorous, the dark bands being

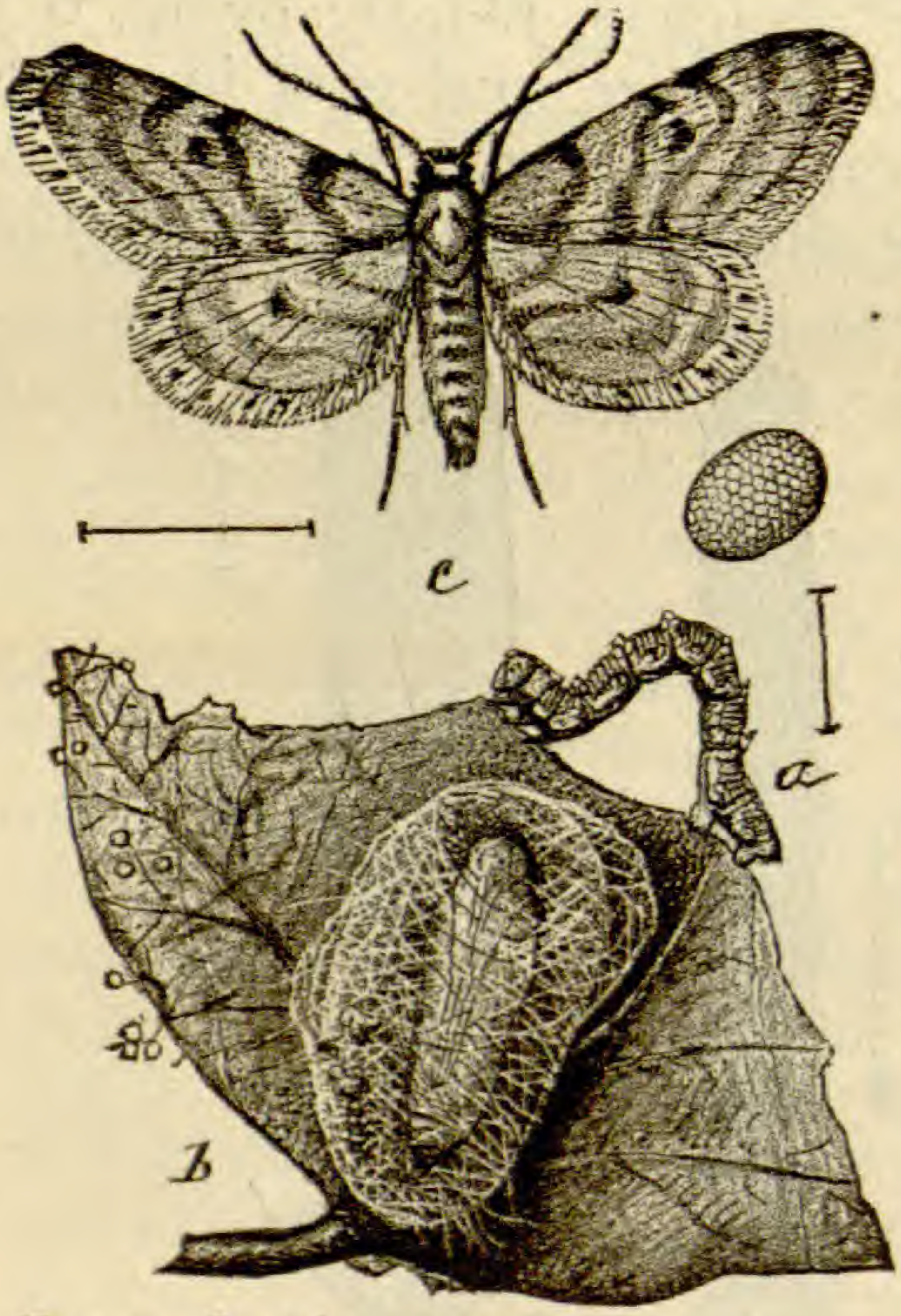

FIG. 2. *Carphoxera ptelearia: a*, larva; *b*, cocoon; *c*, moth; *d*, egg—all enlarged. (Original.)

less distinct, and the discal spot more intensified. The fringes are concolorous with the ground color and with black dots beyond the veins.

This insect has become a source of positive alarm in the Department herbarium on account of its rapid multiplication and the harm it occasions. It behooves botanists to be on the lookout for it and to adopt such measures as will insure immunity from it, if dry specimens are being received from Mexico and the southwest, or from herbaria in which it is known to occur. The custom of poisoning dried plants with corrosive sublimate to protect them from various enemies, such as book mites, Psoci, etc., should give immunity from the attacks of this insect if the poison has been thoroughly applied. If to the corrosive sublimate a quantity of arsenic is added, the protection will be more effectual. I would also recommend as very useful in disinfecting herbaria of this and other pests an air-tight quarantine box of zinc or galvanized iron in which the plants may be temporarily placed and submitted to the fumes of bisulphide of carbon, which are very sure to destroy all insect life. Effective steps have already been taken to prevent the sending out from the Department of any infested specimens in future.

The fact that this insect has appeared in dry plants from the comparatively arid western regions may furnish a clew to its original habit. It is presumable that it normally feeds on the dead or dried plants of Mexico and adjacent arid regions, and that it has simply adapted itself to the somewhat similar conditions prevailing in herbaria.

This is the first true Geometrid, so far as I know, recorded as feeding on dry and dead vegetation. In the Pyralidina a number of species are known to be not only truly carnivorous, feeding on other insects, but also to feed upon grass and rejectamenta as well as dead leaves. Some Tineina are also known to have similar habits, while in the Deltoid group of Noctuids several genera are known to feed on dead leaves.

The illustrations, which have been prepared for *Insect Life*, are used by permission of the Hon. Edwin Willits, Assistant Secretary of Agriculture, who desires to give the facts in the case as wide circulation as possible, and who is particularly anxious that the Department shall not be the means of distributing any undesirable introductions.

U. S. Dept. of Agric., Div. of Entomology.

Notes upon Peronosporeæ for 1891.

BYRON D. HALSTED.

The season now closing has been an average one as to the total amount of rainfall, but the two previous years were moderately wet ones, and particularly 1889. Of special note in this connection is the amount of rain that fell during the month of August, namely, 5.32 inches on an average throughout the state; while the September precipitation was not so great but near the average.

PHYTOPHTHORA INFESTANS D. By. While not one quarter as prevalent as last year this rot has not been absent, especially among the late potatoes. It was first observed in July, about ten days after a series of rains. The writer is more than ever convinced that much of the decay of Irish potatoes in the East is due to bacteria and the Phytophthora gets credit for much more damage than is its due.

SCLEROSPORA GRAMINICOLA (Sacc.) Schr. which is common upon *Setaria viridis* and *S. Italica* in Iowa, has not yet been found in New Jersey. The first host for this mildew gives one of the best illustrations of how the sustaining tissue breaks up into fine shreds as if to facilitate the dispersion of the oospores as it doubtless does.

PLASMOPARA VITICOLA (B. & C.) Ber. & De T. was comparatively rare upon the grape during the early part of the year, but after the crop was removed the mildew showed itself upon the mature leaves in remarkable abundance. So rapid and great was its growth in September that the vineyardists frequently mentioned the fact of their own accord. This seems to be a striking example of the mildew being associated with the moist weather of the autumn. It has been again observed that the lower leaves, that is, those nearest the soil, are the most certain to be attacked, leaves lying upon the earth being worst of all. It has not been as abundant upon *Ampelopsis quinquefolia* and *A. tricuspidata* as last year.

PLASMOPARA PYGMÆA (Ung.) Schrœt. was found in small quantity in early spring upon *Anemone nemorosa* but not met with upon its other hosts.

PLASMOPARA GERANII (Peck) Berl. was in early spring one of our most abundant and conspicuous members of the group, as upon *Geranium Carolinianum* it covered the leaves with a white felt and developed a premature reddening of the affected foliage. In midsummer it disappeared only to appear again upon the seedling plants in autumn ready for its hibernation in the substance of its hosts. It was taken also upon *G. maculatum* but not upon *G. Robertianum.*

BREMIA LACTUCÆ Reg. has only been met with upon garden lettuce and principally in green-houses where it did some damage.

PERONOSPORA PARASITICA D. By. is one of the most widespread and common of all the mildews. It has been observed on nearly all the ordinary hosts, as *Cardamine hirsuta* and *C. laciniata* in early spring, and radish and cabbage later in the season. A new host apparently in *Alyssum maritimum* was found affected, growing in a green-house with radishes near by, likewise infested. The Cruciferæ in general are subject to the attacks of this mildew.

PERONOSPORA CUBENSIS B. & C. has been the most interesting species this season. It will be recalled that this mildew, in the spring of 1889, was known only in Japan, Cuba and this state. During that year it was found in the southern states. Last year it was only rarely met with, but almost daily looked for. Until midsummer of the present season it had not been found, but since then it has appeared, literally almost everywhere in this region, and through correspondence it is learned that it is very wide spread and general. From Professor Galloway I learn that it is abundant in Washington, and Dr. Sturgis sent specimens from New Haven, where it was common upon watermelon. Upon the same host it seems accountable for the failure of the crop to some extent in this vicinity. No oospores have been met with, but the rapid germination of the violet conidia by zoospores is easily demonstrated. The wild species of Cucurbitaceæ, namely, *Sicyos angulata* and *Echinocystis lobata*, have been examined with the hope of finding the mildew, but without success.

PERONOSPORA EFFUSA Rabh. has been much more abundant this season than formerly. The crop of spinach now standing in some places is badly spotted with the mildew, which will materially shorten the crop.

PERONOSPORA POTENTILLÆ D. By. has been taken occasionally upon the common host *Potentilla Norvegica*, but of most interest is the finding of it upon *P. grandiflora* which, while recorded in Saccardo, is perhaps new to this country. The oospores were in abundance. It was also luxuriant upon *Potentilla Nepalensis*, in which also oospores were present.

CYSTOPUS IPOMŒÆ-PANDURATÆ Farl. has been abundant upon the sweet potato foliage and the oospores in the galls of the *Ipomœa pandurata* as mentioned last season. In no case were the galls found upon the former host.

CYSTOPUS CANDIDUS (Pers.) Lév. has its long list of hosts, and in this is a match for *Peronospora parasitica*, both frequently growing together upon the same species of Cruciferæ. Fine specimens with chalky white patches of large size were found unusually abundant upon some horseradish plants, and in this vicinity during June the shepherd's purse is fortunately quite seriously affected by this white mold.

CYSTOPUS PORTULACÆ (DC.) Lév. in like manner assists materially in killing off the purslane.

As a whole this has been a year in which the mid-season was characterized by few Peronosporeæ, but the quota has been well filled by the rapid development of several species in great abundance late in the season. The frosts of autumn held off unusually late, and this, together with the heavy rains, gave these parasites a good opportunity to make a rank growth. The other points of particular interest have been the finding of *Peronospora parasitica* upon *Alyssum maritimum; P. Cubensis* in great abundance upon cucumber, pumpkin and squash, and quite destructive to watermelons; *P. effusa* abundant upon spinach; and *P. Potentillæ* upon *Potentilla grandiflora* and *Potentilla Nepalensis*, both hosts abounding in oospores.

Rutgers College, New Brunswick, N. J.

New plants collected by W. G. Wright in western Mexico.

B. L. ROBINSON.

Ayenia Wrightii.—Fruticose: branches terete, smooth: leaves ovate, acuminate, rounded at the base, serrate, glabrous on both sides, a little paler beneath, 1½–2 inches long, half as wide; some much smaller leaves, 4–6 lines in length, fascicled together with the flowers in the axils of the larger ones ; petioles 3–9 lines long : flowers two to five in a group, without a common peduncle; pedicels 3 lines in length; sepals lanceolate, acuminate, about a line long; petals with blades broadly rhombic, entire at the attachment of the hair-like claw, but with four teeth near the apex, the two inner teeth very minute, close to the adnation to the staminal cup, the outer much larger, acuminate, abruptly bent downward and backward ; anthers two-celled ; ovary raised on a slender stipe of 1 line in length; fruit 1½–2 lines in diameter, covered with numerous small dark glands.—Head of Mazatlan River, January, 1889 (No. 1307). Differs from *A. truncata* Rose in its terete branchlets, the longer and more slender stipe of the ovary and in the character of its fruit.

Mimosa affinis.—Annual, sensitive: stem ascending, simple or branched, hirsute with spreading or reflexed yellowish-brown hairs and armed with small recurved sub-stipular and scattered spines: petioles an inch long, bearing a single pair of pinnæ: leaflets 9–12 pairs, oblong, acutish, 5–7 lines long, the lowest pair appressed-pubescent upon the lower surface, the others nearly glabrous except on the ciliate margins; stipules awl-shaped, striate, ciliate; stipels bristle-formed, more or less rigid and dark-colored : peduncles shorter than the petioles, bearing small nearly spherical heads 2–2½ lines in diameter; bractlets awl-shaped to bristle-formed, ciliate, exceeding the flowers; corolla 4-parted; stamens 4; legumes 1–4 seeded, about 6 lines in length, 2½ lines broad, the surface minutely pubescent, and the more or less persistent margins provided with numerous very short recurved hooks (¼–½ a line in length).—Growing in grassy land among cocoanut trees, Mazatlan and vicinity, January, 1889 (n. 1218 and 1265). These plants having the habit of *M. pudica* L. differ constantly from that species in their smaller heads, and in the characters of the fruit. In M. pudica the legume is ciliate with less numerous, much longer, coarser bristles, which are not at all reflexed. Furthermore, the stipels in M. pudica are green and much less bristle-like.

Buddleia (§ Globosæ) **Wrightii.**—Shrub: branches and branchlets slender, terete, minutely striate, smooth : leaves thin, lanceolate, sharply acuminate, long-attenuate to a slender slightly margined petiole, serrate, covered on both surfaces with a close and inconspicuous canescent stellate puberulence, green above, paler beneath, including petiole 4–5 inches long, 1–1¼ inches wide, the uppermost smaller, entire: peduncles in pairs, axillary, smooth, 5–10 lines long; heads 5–6 lines in diameter; calyx tomentous, obtusely four-toothed; corolla 1½ times as long as the calyx, hairy within; stamens and clavate entire stigma included.—A "willow-like bush," head of Mazatlan River, January, 1889 (n. 1282). Distinguished from the South American *B. globosa* Lam., *B. polycephala* HBK. and others by its thinner leaves and the absence of the dense ferruginous tomentum characteristic of those species; from *B. connata* Ruiz et Pav. by its narrow petioles, which are merely connected by a line and are not truly connate.

Citharexylum Cinaloanum.—A slender shrub, 4 feet high: branchlets striate, roundish or slightly 4-angled, canescent-tomentulous: leaves ovate or oblong, usually acuminate, rarely obtuse at the apex, acute at the base, entire or with a few shallow teeth toward the apex, pale, nearly glabrous but slightly roughish above, with short canescent tomentum beneath, 1¼–2½ inches long, half as broad; petioles 2–4 lines long: spikes single, terminal, slender, nodding; bractlets minute, subulate; flowers subsessile; calyx campanulate, 1 line long, striate, pubescent, with 5 very short acuminate slightly spreading but not reflexed equal or sub-equal teeth; corolla white, pubescent within and without, exceeding the calyx by half; segments erect; fertile stamens four; rudiment minute; style glabrous; fruit dark, 2 lines in diameter.—Mazatlan, January, 1889 (n. 1225). Very nearly related to *C. Berlandieri* Robinson, but differing in its larger, usually more acuminate leaves, its campanulate rather than turbinate calyx with acute instead of blunt lobes, in the erect lobes of the corolla, and the glabrous style; the corolla-lobes in C. Berlandieri being larger and more spreading and the upper part of the style puberulent.

Gray Herbarium, Cambridge, Mass.

Noteworthy anatomical and physiological researches.

CONWAY MAC MILLAN.

Influence of gravity on sleep-movements.[1]

Fischer has attempted in these researches to discover the influence of gravitation upon the positions assumed by nyctitropic organs during the changing diurnal and nocturnal conditions. The method of experimentation adopted was simple. Two groups of cultures were arranged, in one of which plants were placed in abnormal inclinations to the plane of gravity-stimulation, while in the other, the plants were rotated upon the klinostat. By these means it was possible to show that the plants experimented upon could be grouped in two classes: (1) those which continued the nyctitropic movements regardless of the direction from which the force of gravity acted; and (2) those which failed to assume nyctitropic positions in the absence of normal gravity-stimulus. The first group of plants—to which belong Trifolium pratense, Portulaca sativa, Cassia Marylandica, Oxalis lasiandra, Acacia lophantha and others—is named by Fischer *auto-nyctitropic*. The second group, apparently smaller than the first, includes Gossypium arboreum, Phaseolus multiflorus, Lupinus albus and certain Malvaceæ, and is named *geo-nyctitropic*. These experiments, if extended, might be fruitful in explaining some difficult problems in plant positions. It would seem particularly desirable to determine, if possible, for a number of plants, the critical angle at which nyctitropic movements fail to appear. This is a line which might easily be investigated in many American laboratories.

Effects of transpiration and darkness on form.[2]

Wiesner here continues experimentation somewhat along the line indicated by Palladin and others, with reference to the connection between the form of a plant and its rate of transpiration. He has examined more particularly those plants which normally form a basal rosette of leaves, as in the case of Taraxacum, Capsella, Sempervivum, etc. He finds that the behavior of different plants in a saturated atmosphere is by no means the same, but that there may be distinguished at least four types.

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[1] A. Fischer: Ueber den Einfluss der Schwerkraft auf die Schlafbewegungen der Blætter. Botanische Zeitung, 1890.

[2] J. Wiesner: Formænderung von Pflanzen bei Culture im absolut feuchten Raumer und im Dunkeln. Berichte der deutschen bot. Gesellsch., 1891, p. 46.

(1) The rosette of radical leaves is loosened through lengthening of internodal areas, both in darkness and saturated atmosphere. This is the case in Sempervivum tectorum.

(2) There is no change of shape in obscurity or in a saturated atmosphere. This is the case in Oxalis floribunda and Plantago media.

(3) The plant undergoes dissociation of the radical rosette in darkness but is unaffected by a saturated atmosphere. This is the case in Taraxacum officinale.

(4) The radical rosette is dissociated in the saturated atmosphere but is unaffected by obscurity. This is the case in Capsella bursa-pastoris.

Wiesner holds that in type 1 the internodal elongations are in both cases due to increased transpiration. Type 2 he finds difficult and calls into court that witness of last resort, heredity, saying that there has been produced a *phylogenetischen Entwicklung* which can not be modified by changing conditions in the life of a single culture plant. Type 3 is explained by considering that light retards growth while transpiration has little or no effect, and Type 4 indicates that transpiration may be the condition of extended growth, while light has little influence, or none at all.

It does not seem at all certain that all of these explanations are final. Type 2 could be better explained by some cause separate from those investigated, acting either actively or conservatively, to modify or inhibit the influence of the light and transpiration current. The writer called attention in the GAZETTE of May, 1890, to a peculiar epinastic position of Solanum leaves under certain conditions which, he has since come to believe were principally of modified transpiration. This same plant was afterward examined by Vöchting[4] and very good photographs given of the peculiar epinastic position. The Solanum plant also behaves in an interesting manner in a saturated atmosphere, assuming much the appearance of an etiolated plant. This was recently determined at the laboratories of the University of Minnesota. In a saturated atmosphere the leaves, however, continue to be strongly epinastic, although exceedingly small. There is also a formation, of course, of chlorophyll, and these differences suffice to distinguish between the etiolated and *hydrolated* plant. The interesting point is the permanent epinasty induced by atmospheric hydrolation; it is quite as marked in the small hydrolated leaves of Solanum tuberosum as in the large normal leaves of the same plant. Along this line further researches would supplement Wiesner's work and probably confirm and extend the investigations of Palladin. At any rate the Solanum tuberosum is recommended as a highly sensitive hydrolitic plant, and its further examination suggested to botanical workers as of much probable interest.

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[4] H. Vöchting: Laubblætter und Assimilationthatigkeit, Bot. Zeit., vol. 49, no. 9.

A monograph of plant-torsions.[1]

It is quite impossible to do justice to this voluminous and painstaking record of physiological research in a brief review. Mention will be made, therefore, of but one among the very numerous points of interest. In his researches upon the torsions in plant-organs, De Vries has had occasion to study particularly the Dipsacus sylvestris, a plant prone to exhibit these anomalous twistings of stems and leaves. He has accordingly cultivated the plant for many years in the botanical garden at Amsterdam. In six years, by careful selection, this distinguished investigator has established a variety of the teasel which is so constantly characterized by torsions in the stem and leaves that he proposes for it the name of Dipsacus sylvestris torsus. That these monstrous plants can be so rapidly produced by a systematic process of seed-selection is indeed worthy of note. For figures and descriptions the reader is referred to the article itself, which is one of the two or three most notable botanical works of the past year.

University of Minnesota, Minneapolis.

BRIEFER ARTICLES.

Atriplex corrugata, n. sp.—Diœcious, shrubby at base, much branched, about a foot high, hoary throughout with a dense scurfy pubescence, very leafy: leaves linear-oblanceolate or -oblong, obtuse or acutish, entire, 3 to 6 lines long: staminate flowers in short crowded terminal spikes; pistillate flowers in axillary clusters; bracts thick and spongy, 1½ to 2 lines long, obovate, united to above the middle, the free margins above broad and truncate or rounded or acutish, entire, the sides very variously and irregularly appendaged with spongy tubercles or crests which have usually a corrugated appearance when dry.—Nearly allied to *A. Nuttallii.* Discovered by Miss Alice Eastwood at Grand Junction, Colorado, in well formed fruit on 20th May, 1891. Miss Eastwood notes it as the earliest in fruit of several perennial species of the genus growing in the same locality.

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[1] Hugo de Vries: Monographie der Zwangsdrehungen. Pringsheim's Jahrbücher für wiss. Botanik, xxiii, pp. 13–206.

RANUNCULUS GLABERRIMUS, Hook.—This common alpine species of the western mountains is much more variable in several respects than the published descriptions would indicate. The leaves vary from broad to narrow, and though the cauline leaves are ordinarily lobed, at least some of them, yet it occasionally happens that all are entire. The plant is as a rule wholly glabrous, but the sepals are sometimes sparsely villous with white hairs, and the achenes are either smooth or finely pubescent. This more pubescent form, as collected by Mr. Siler in southern Utah with entire leaves, was referred by Dr. Gray to *R. Lemmoni,* which species is as yet known only from the original locality in the Sierra Nevada.

RANUNCULUS MACAULEYI, Gray.—Fine fruiting specimens of this rare species have been recently collected by Miss Eastwood in the Elk Mountains above Irwin, Colorado. The achenes are small, in an oblong-ovate head, smooth, somewhat compressed, and beaked with a rather long linear-subulate straight style. The species appears to be well distinguished from *R. Altaicus* by its pilose-ciliate leaves, glabrous linear-oblong receptacle, and longer styles.—SERENO WATSON, *Cambridge, Mass.*

The sterile flowers of Panicum clandestinum.—The past season there was brought into the laboratory by a student a specimen of this species in which the sterile flowers had three well developed stamens. According to Gray's Manual, the lower or sterile flower is "(always?) neutral." On examination of a large number of specimens from this vicinity, it was found that by far the greater number had the lower or sterile flowers staminate. Specimens from Nebraska showed many staminate flowers also. Michigan specimens had the sterile flowers neutral. It was also observed that specimens collected early in the season had a larger number of staminate flowers than those collected later.—THOS. A. WILLIAMS, *State Agricultural College, Brookings, S. D.*

Peculiar forms of proliferation in timothy. (WITH PLATE XXVI.)—In a small plat of Timothy growing on the Experiment Station grounds of the University during the past season, a number of specimens showing these two forms of proliferation were found. Such specimens were especially numerous along an irrigating ditch which ran through the plat. This abnormal development was probably the effects of an over-supply of water. The form *A*, I have observed before. It is frequently produced in wet seasons on low and cold soil. In this case the floral glume is changed to a leaf, with other parts of spikelet normal. *a* represents an enlarged spikelet.

In the form *B* the spikelet is much changed from the normal. In a number of specimens there are four glumes, from between the inner pair of which extends a long stipe, generally more or less twisted and surmounted by a perfect flower. In some cases there are but two glumes below, with long stipe and perfect flower as before. In either case the glume above is very large, sometimes changed to a leaf, while the palet is inconspicuous, or there is none at all. *b* represents a spikelet of this form with four glumes below.—J. W. TOUMEY, *Botanical Laboratory, Univ. of Arizona.*

Iris hexagona.—In August, 1889, I collected at Carlinville in south-central Illinois fruiting specimens of an Iris whose species was not at the time determined because of the absence of flowers. In the season of 1890 the flowering period of the species passed without observation. A special watch was kept during the past summer and in early June the plant was taken in full bloom. With the exception of two points, viz., size of capsule and distribution the features of the plant tallied with the description of I. hexagona. Specimens were therefore sent to Dr. Sereno Watson who identified it as above designated. While the known distribution would suggest its occurrence in this state a careful search has found no record of such occurrence.—W. E. ANDREWS, *Carlinville, Illinois.*

EDITORIAL.

OUR READERS are invited to inspect carefully the table of contents and list of contributors which accompany this number. By doing so they will get a comprehensive view of "the high character and variety of the original communications"—to use the commendatory phrase of one of our most eminent friends. The printed pages bear evidence of much valuable research which we esteem it a privilege to publish. Our readers have a large and distinguished company to thank for whatever of interest and instruction they have gained from the journal during the past year.

THE CLASSIFICATION of the original articles is of some interest Naturally taxonomy and morphology lead with 44 titles, of which 32 belong to phanerogams and 12 to cryptogams; physiology stands next with 17 (including four entries relating to flowers and insects); anatomy and development have 10; teratology and variations 6, apparatus and methods 4; plant diseases 2; and reports of societies, etc., 5. Making allowance for the various other places of publication the relative numbers of articles probably represent fairly the character of work which is now going on, if we except the study of plant diseases. The economic bearings of this study usually determine the publication of articles on these subjects elsewhere.

WHEN THE great increase in sources of publication is considered it is rather surprising that the supply for a journal covering so wide a field as this continues unabated. The *Bulletins* of the Agricultural Experiment Stations, the *Proceedings* of various societies and academies, the *West American Scientist*, *Zoe*, the *American Naturalist*, the *American Journal of Science*, the *American Garden*, *Garden and Forest* and other similar journals contain many botanical articles; the *Annals of Botany* takes off some of the longer papers; while the *Bulletin* of the Torrey Botanical Club and the *Journal of Mycology* are replete with original articles and summaries of current work. Is there, by reason of these abundant sources of publication, temptation to the sending out of hasty and incomplete work ?

THE EDITORS' LABOR during the year has not been inconsiderable. Twenty works have received extended review, and nearly fifty shorter notices have been written to keep abreast of the "Current Literature" sent to our table for review. Under the heading "Notes and News" have appeared nearly 200 items, giving a great variety of information about current events in the botanical world. This, together with the routine work connected with the regular issuance of the journal, has involved an expenditure of energy which few can appreciate who do not know it from experience. It has been to the editors a labor of love, however. They hope that the readers of the GAZETTE have been helped by it to a wider knowledge and a more zealous study of the science which we all delight to honor.

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ATTENTION is called to the announcements on the last page of the cover.

CURRENT LITERATURE.

Minor Notices.

EVER SINCE homologies were known to exist between heterosporous pteridophytes and phanerogams the genus Isoetes has been one of peculiar interest, for it has seemed of all known pteridophytes most nearly related to phanerogams. Dr. Douglas H. Campbell, whose work in the life-histories of pteridophytes is well known, has made a careful study of the life-history of a species of Isoetes (I. echinospora, var. Braunii), and has published his results in *Annals of Botany* (Vol. V. no. 19, Aug. 1891), illustrated by three double plates. He has traced the development of the male prothallium, the macrospore and female prothallium, and the embryo as to its leaf, root, and foot). While the details of technique are both interesting and instructive, for the subject was beset with unusual difficulties of manipulation, the interest naturally centers about the conclusions with regard to the relationship of Isoetes. The genus has been ordinarily placed among the Lycopodineæ, although Vines has called attention to its closer relationship to Filicineæ, to which latter view Campbell also inclines, and his results seem to bear him out in this view. However, Isoetes still seems widely isolated at best, and its relationship to Filicineæ, while nearer than to any other pteridophyte group, may still be considered a somewhat distant one. While nearest to the Filicineæ, it still seems to have closer homologies with phanerogams than any other pteridophyte. Campbell has succeeded in making the very important point that these homologies are with the monocotyledons rather than with the gymnosperms, thus emphasizing the notion of the independent origin of the angiosperms from the pteridophytes and the further notion of the origin of monocotyledons from the Filicineæ through such forms as Isoetes. Of course the intervals are still far too great for definite conclusions, but these results with Isoetes are full of suggestions for future investigations.

THE SEVENTEENTH contribution from the cryptogamic laboratory of Harvard University is by William Albert Setchell, under the title "Concerning the life-history of Saccorhiza dermatodea." It is a reprint from Proc. Am. Acad. XXVI., distributed September, 1891. It deals with a very complex and polymorphous member of the Laminarieæ. Dealing first with its discovery by De la Pylaie, its distribution, habitat, and season, the author treats its morphology under four periods, each characterized by some important changes in development. Then follows a complete account of the histology of each of these periods, and then a discussion of relationships to certain specific forms and other Laminarieæ in general. That the species is a polymorphic and somewhat confusing one may judge by the fact that in literature it appears under five generic names with nine different specific combinations.

In an article entitled "The vitality of some annual plants," reprinted from the October number of the American Journal of Science, Mr. Theo. Holm instances a number of annual plants of which he has found individuals having arrangements for living over winter.

Mr. Henry Eggert has published a catalogue of the Phanerogams and Pteridophytes in the vicinity of St. Louis, the radius being about 40 miles. This is the first complete list of this interesting region since Geyer's Catalogue of 1842. The list contains about 1100 species, and Mr. Eggert's long and patient study of the St. Louis flora insures a list both complete and accurate.

NOTES AND NEWS.

Dr. Aug. F. Foerste sailed for Europe the middle of last month, and is now at the Collége de France, Paris.

On page 273 the Gazette tried say that Mr. T. *Kirk* of Wellington, New Zealand, was preparing plants of that country for distribution at *45 shillings* per century.

Dr. Arthur Meyer has been called to the professorship of botany in the University of Marburg. Dr. F. G. Kohl, heretofore *privatdocent*, has been made assistant-professor.

Dr. Hermann Hoffmann, professor of botany in the University of Giessen, is dead at the age of 72. Plant climatology, geography and phænology are the branches to which he gave especial attention. Indeed the latter subject owes most of its present development to his labors.

Three of the six established scholarships for garden pupils of the Missouri Botanical Garden (St. Louis) are to be awarded before the first of April next. Those who desire full information concerning the great advantages offered by these scholarships, and the conditions upon which they are awarded, should address the Director, Dr. William Trelease.

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[1] pp. 292—309, with plate XIII.

GENERAL INDEX.

⁂ The more important classified entries will be found under the following heads: *Diseases, Geographical Distribution, Hosts, Journals, Necrology, Personals, Reviews.*

⁂ Names of synonyms are printed in *Italics;* names of new species in **bold-face;** † signifies death.

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ERRATA.

p. 22, line 7, for hyhæ read hyphæ.
p. 26, line 2, for inside read method.
p. 26, line 9, for Sigmiodeomyces read Sigmoideomyces.
p. 26, line 11, for when read where.
p. 62, line 3, for Colletotrichium read Colletotrichum.
p. 76, line 9 from bottom, for inclines read inclined.
p. 77, last line, *dele* not.
p. 100, line 12, for oxylepsis read oxylepis.
p. 107, line 10, insert S. after 17.
p. 137, line 3 from bottom, for sap read sop.
p. 138, line 3, for sap read sop.
p. 138, line 20, for savory read curry.
p. 139, line 12, for mashed read washed.
p. 139, line 4 from bottom, for ocara read ochra.
p. 139, footnote 41, for Lechium read Sechium.
p. 140, line 2, for pie read pea.
p. 140, line 5, for roots read nuts.
p. 140, line 15, for Lucca read Lucea.
p. 147, line 18 from bottom, *dele* n. sp.—The species was previously described in the *West American Scientist.*
p. 149, line 18 from bottom, for sasisfactorỳ read satisfactory.
p. 188, line 22, insert Station after Experiment.
p. 199, line 16 from bottom, for Pirus read Pinus.
p. 210, line 13, insert translation of before Strasburger's.
p. 213, make $\left\{\begin{matrix}\text{syncarpous}\\\text{apocarpous}\end{matrix}\right.$ follow compound.
p. 240, transpose the two footnotes.
p. 273, lines 6 and 9 from bottom, for King read Kirk.
p. 273, line 6 from bottom, for $4.50 read 45 sh.
p. 289, line 7, for gossypii read Gossypii.

PLATE XXVI.

J.W.T. Del.

TOUMEY on PROLIFERATION.

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FOR 1892.

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AN INCREASE IN SIZE

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With the beginning of 1892 the publication office changes from Crawfordsville to Bloomington, Ind. This is the second change in the sixteen years of the existence of the journal. It was published at Hanover, Ind., from its beginning in 1875 to 1879, and at Crawfordsville from 1880 to the present time.

The subscription price remains unchanged,

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JOHN M. COULTER, Bloomington, Ind. **CHARLES R. BARNES**, Madison, Wis.

J. C. ARTHUR, La Fayette, Ind.

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